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International Operational Agriculture Monitoring Program

USDA Foreign Agricultural Service

Pakistan: Crop Progress Report

MY 2010/11

February Summary **February 26, 2010**

(1) The current outlook for national wheat production in MY 2010/11 is below average, given generally poor winter rainfall in northern Pakistan and apparently insufficient irrigation supplies in Punjab province. In particular, Pakistan's major rainfed wheat growing areas (especially in northern Punjab) are displaying very poor crop development, while irrigated wheat crops over large areas in Punjab are also displaying less favorable development than last year and from the long-term (6-year) average. Wheat crops have already passed peak reproductive growth phases in Sindh province, while they are now reaching that stage in Punjab. The timing of peak reproductive growth stages is vital in determining wheat yield potential. Excellent moisture conditions during the next 4-6 weeks will be extremely important in improving Pakistani's wheat yield potential. That is, the grain-filling period of the MY2010/11 crop, and thus its yield, could be enhanced if weather and soil moisture conditions improved substantially between now and just prior to harvest.

(2) Below-normal rainfall conditions persisted throughout the winter months for the majority of wheat growing areas in Pakistan. This was a stark change from the generally above normal rainfall conditions which prevailed during the past two growing seasons (MY 2009/10 & MY 2008/09) and illustrated in Figures 2-4. A strong cold front in early February brought up to 4 inches (100mm) of rain to parched northern growing areas, but this moisture was largely too late to substantially improve wheat crop development. Total seasonal rainfall between October 2009 and February 2010 in Northern Punjab and N.W.F.P averaged 125 – 210 mm. These amounts were unevenly distributed during the season and less than half the required amount to support normal crop growth. As a result it is expected that MY 2010/11 rainfed wheat production will fall significantly below last year and the 5-year average. Remote sensing data confirmed substantially reduced crop density this season in the major rainfed wheat growing region of Northern Punjab and N.W.F.P compared to MY 2009/10 (Figures 6 - 7).

(3) Analysis of satellite-derived vegetation index (NDVI) data in late January, with values aggregated over entire districts, revealed the general condition of this year's wheat crop compared to last year (Figure 8). It is apparent from this analysis that the majority of wheat growing districts in Punjab had relatively lower overall vegetative crop development (and thus lower potential wheat production) than last year, with 10 districts having significantly lower crop development. The absence of sufficient winter rainfall in Punjab resulted in significant moisture stress on non-irrigated and irrigated crops alike. In general, most rainfed crops either germinated poorly or withered as dry conditions prevailed through the winter. Insufficient irrigation did very little to substantially offset moisture deficits due to poor winter rainfall. This is evidenced by crop vegetation over very large regional areas showing

less vigor than last year. The NDVI analysis, in general, indicates that roughly 64 percent of total wheat area in Punjab province has worse crop development than last year. Given Punjab has contributed roughly 75 percent of the national wheat crop in the past three years, the relatively poor prevailing crop conditions are expected to cause a decline in national wheat production this year.

(4) A more comprehensive national vegetation index (NDVI) analysis covering the past 32 days provides a detailed look at local and regional crop conditions in Pakistan (Figures 11-14). These maps clearly illustrate the broad regional nature of the change in MY 2010/11 wheat conditions when compared to last year and the 6-year average. Crops in Punjab and N.W.F.P. in particular are exhibiting signs of less robust vegetative growth and potential yield than last year and the 6-year average. At least 10 districts in northern Punjab also exhibit extremely poor crop development (Figures 15-18). By comparison, the NDVI data indicate that crop development in Sindh province was similar to last year and to the long-term average (Figures 19-23). Low resolution satellite imagery from the NASA MODIS satellite indicate that winter crops in southern Sindh province reached peak development by mid-January and proceeded toward senescence during the second half of the month (Figure 24). Meanwhile most crops in Punjab experienced highly active growth (Figure 25).

(5) It should be noted that field conditions throughout Pakistan are mixed, with favorable crops comingled with relatively poorer crops on a local and regional basis. This is largely the result of access to available water and rainfall, and the degree to which this water supply was sufficient or insufficient for optimal crop development. The overall national situation clearly indicates less robust crop development this year, but that does not imply that there are no areas or locations with healthy high-yielding crops. Medium resolution satellite imagery (Landsat, AWiFS) over Pakistan during January and February 2009 -2010 indicates that timely irrigation, where available, alleviated the impact of dry weather conditions and supported vigorous crop development in various locations. Crops located near the headwaters of irrigation distribution systems displayed vigorous growth while crops located at the tail portions of secondary irrigation canals sometimes lagged behind. Depleted stream flow along much of the Indus, Chenab, and Jhelum Rivers was widely evident in the satellite imagery, signaling either reduced availability or higher than average usage. The Chenab River showed signs of low flow along the entire watercourse. The mid-season river width at the headwaters (below Marala barrage, January 26, 2010) declined by approximately 50 percent compared to February 8, 2009 (Figure 26). Further downstream, near the confluence with the Jhelum River above Trimmu barrage, the river width declined from 250 m to 70 m between January 1 and February 2, 2010 (Figure 27). The Indus River width above Sukkur, Sindh province, similarly declined by 50 percent between December 13, 2009 and January 25, 2010. Water levels continued to decline through early February (Figures 28 - 29).

(6) Winter snowpack over the Upper Indus watershed in the northern mountains of Pakistan and its neighboring countries represents the most important source of surface water recharge during the spring and summer months as snowmelt feeds streams and tributaries of the major rivers in the Indus Basin system. Therefore winter snow accumulation in the mountains serves as a future indicator of water availability for the next kharif (summer) season. The SSM/I satellite imagery analysis detected a 40 percent increase in areal snow extent (from

199 to 279 thousand. sq. km) between January 12 and February 17, 2010 (Figure 30). However, the snow water equivalent (SWE) has decreased in some sub-basins. It is possible that warm temperatures and precipitation in late-January and early-February led to a decrease in the snowpack volume. It is also possible that the wet snow is causing an underestimation of SWE by the SSM/I sensor. Satellite imagery analysis on February 14, 2010 detected above normal SWE in the Upper Indus and Sutlej Watersheds; normal SWE in the Chenab Watershed; and below normal SWE in the Kabul and Lower Indus Watersheds. Additional accumulation is possible in all watersheds through early March when the snowmelt season typically begins.

(7) The NOAA Climate Prediction Centers 7-day rainfall forecast for Pakistan indicates moderate to heavy rain will occur over the northern mountains (between 65–150 mm). Light to moderate rainfall is also expected over northwestern Punjab and N.W.F.P. potentially enabling modest improvements in crop condition (Figure 31).

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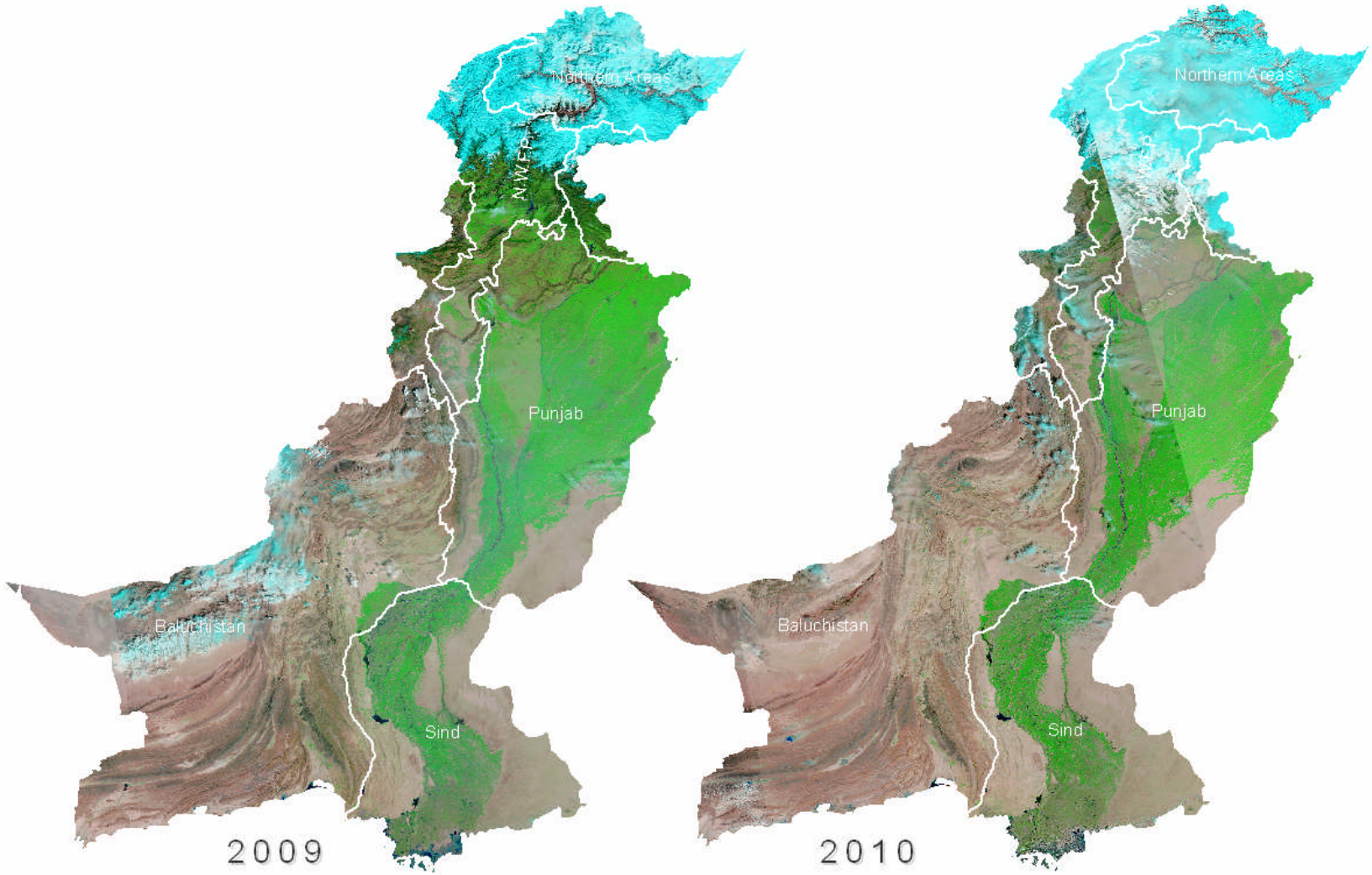
Cloudless MODIS Imagery Mosaic, late February, 2009 and 2010



Data Source: MODIS Terra 7-2-1
Crop Explorer
Supporting: USDA/FAS/OGA/IPAD

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Figure 1. Pakistan late February green-up conditions in 2010 compared to 2009. *Data Source: MODIS 7-2-1 mosaic; tiles dated between 02/23 and 02/25, 2009 and 2010.*

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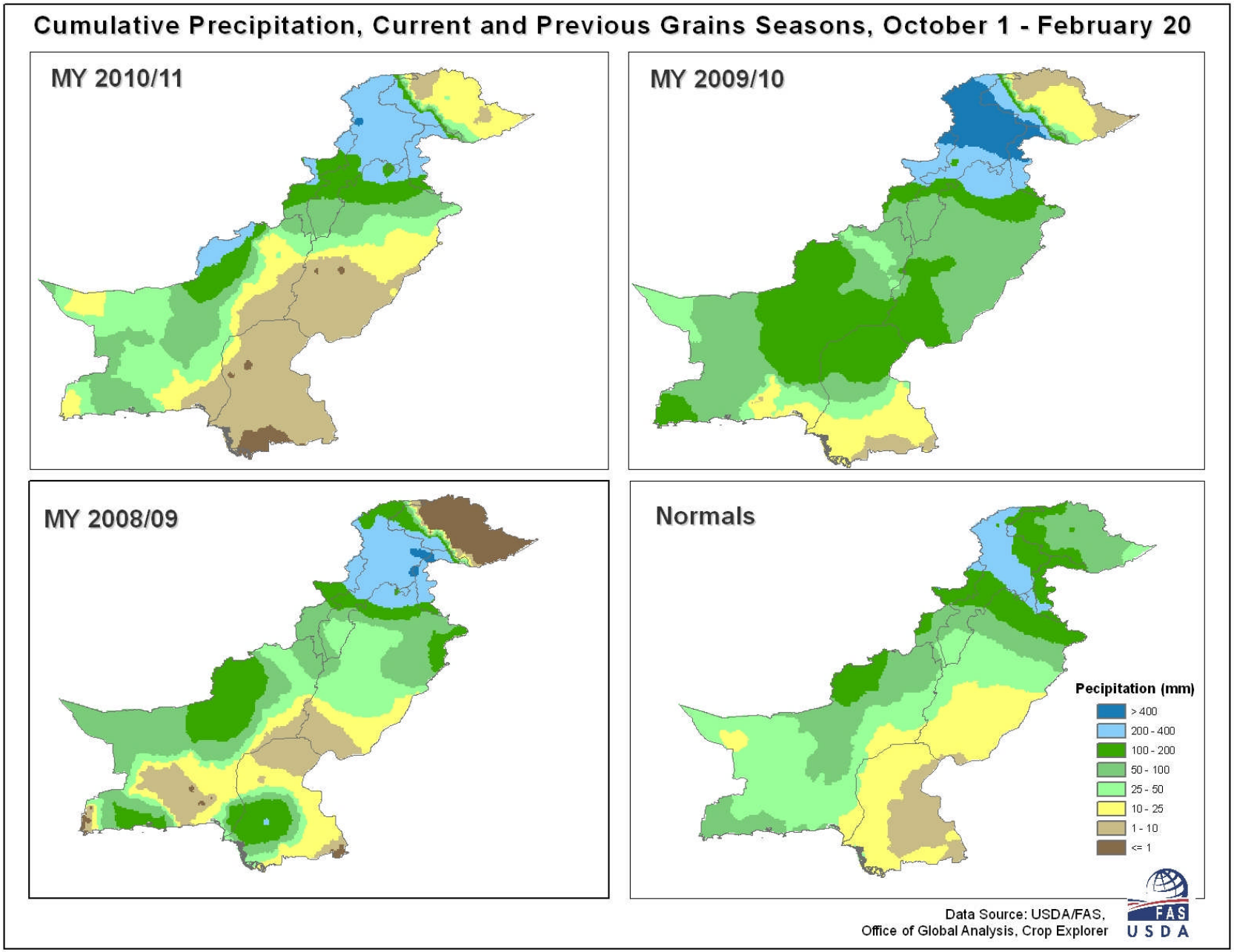

Figure 2. Season to-date cumulative precipitation norm and normal rainfall, October 1 - February 20, 2008-2010. *Data Source: Crop Explorer*

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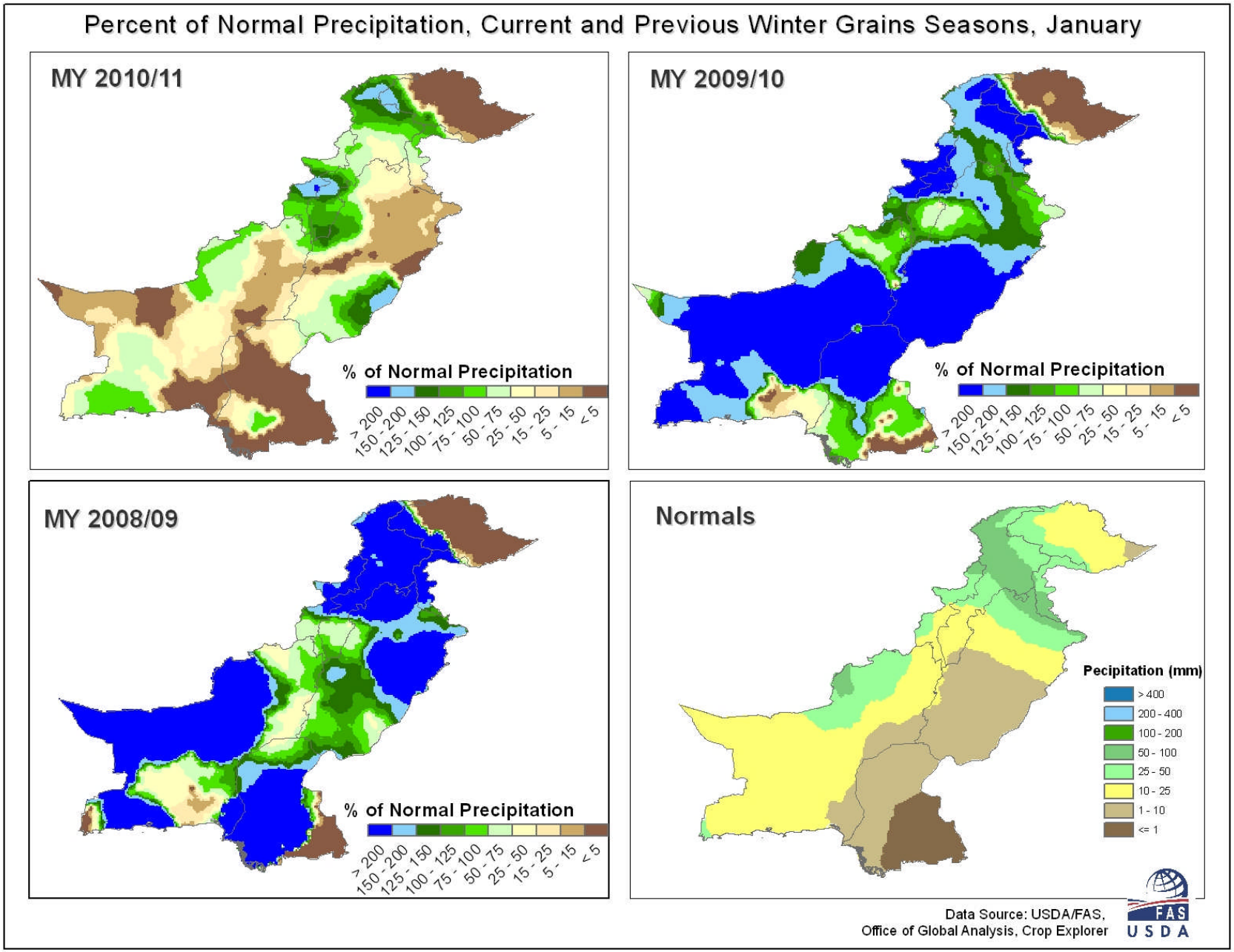

Figure 3. Cumulative precipitation norm and percent of normal rainfall during current and prior two wheat seasons, January, 2008-2010. *Data Source: Crop Explorer*

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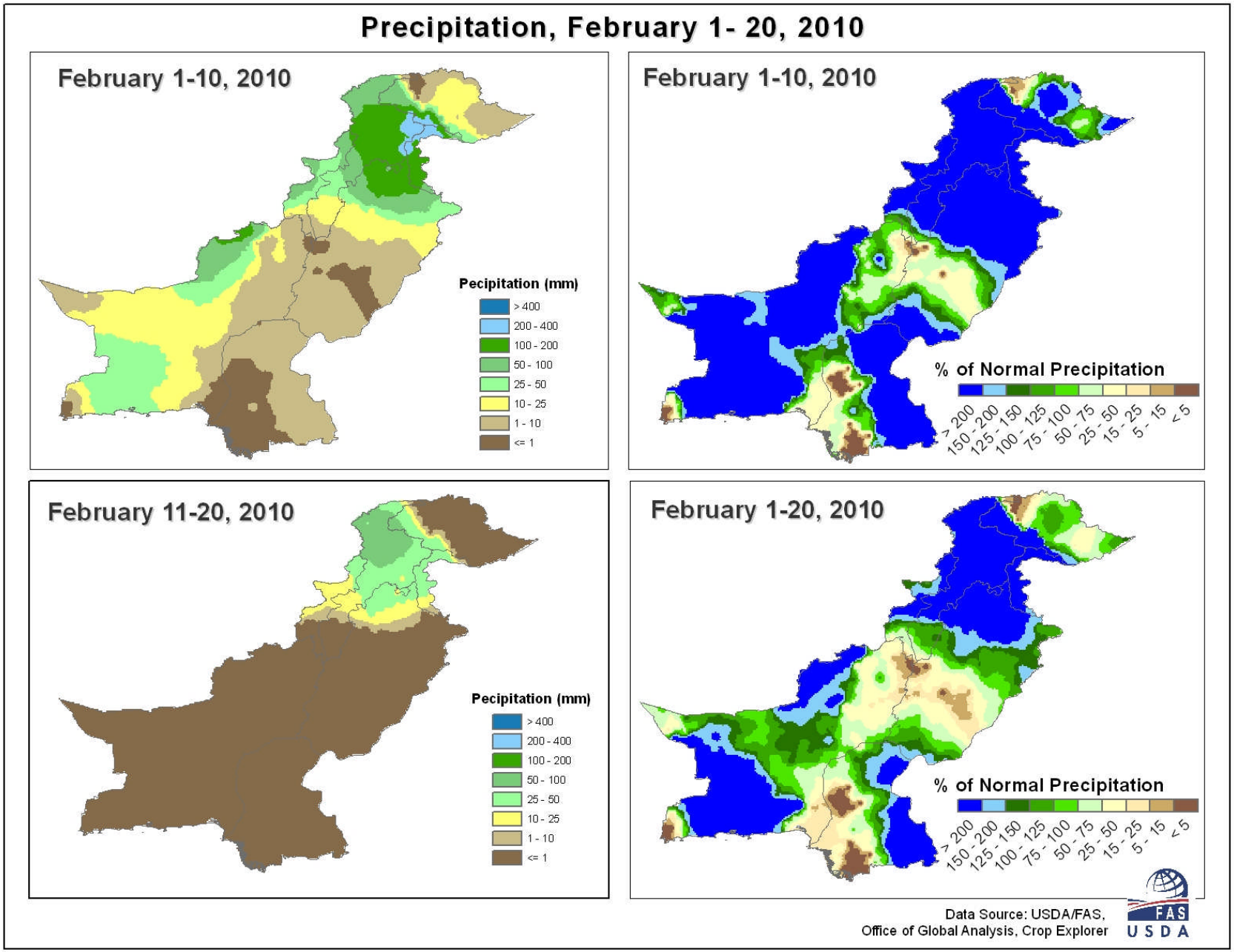

Figure 4. Cumulative precipitation and percent of normal rainfall, February 1 - 20, 2010. *Data Source: Crop Explorer*

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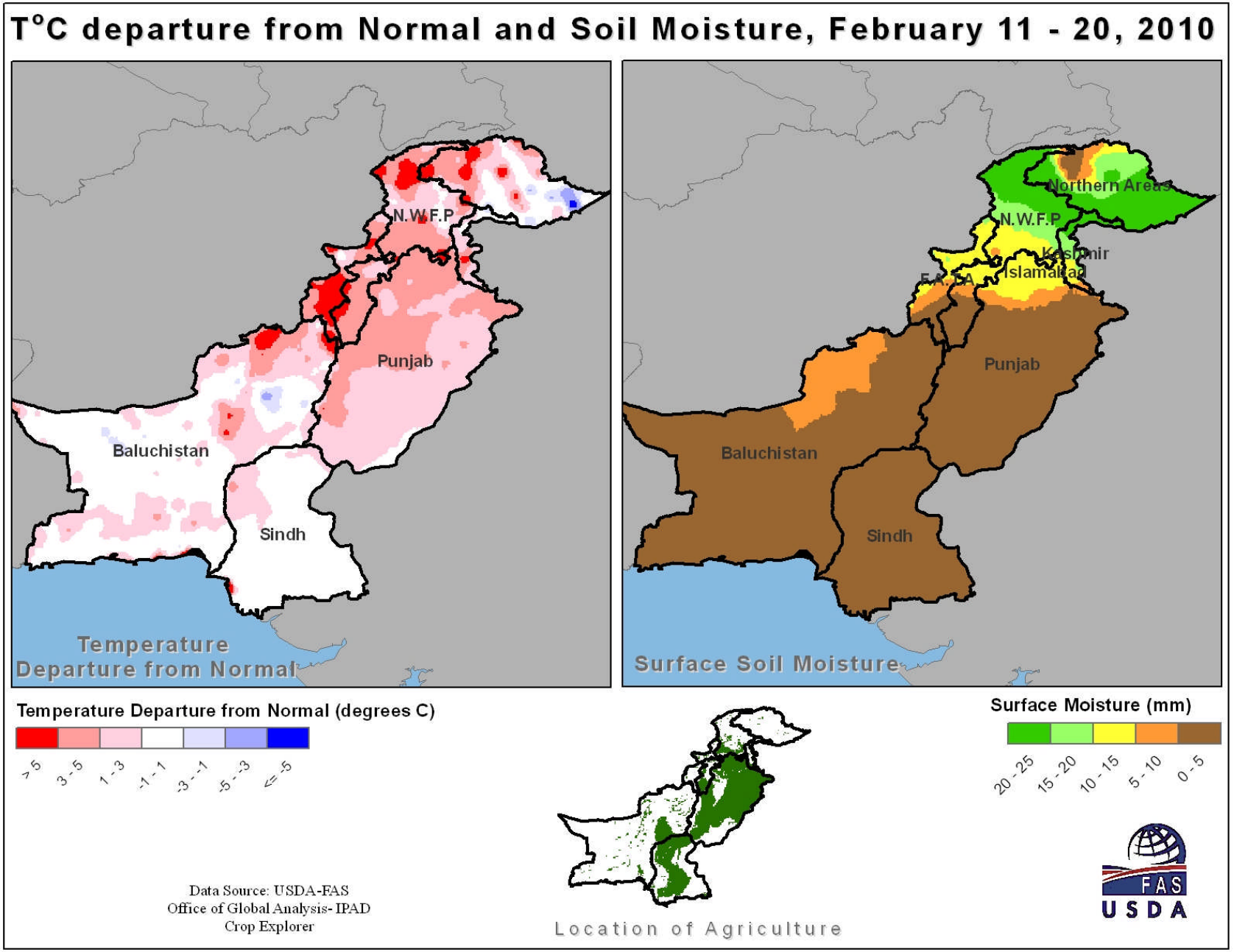

Figure 5. Temperature departure from normal and surface soil moisture content, February 11 - 20, 2010. *Data Source: Crop Explorer*

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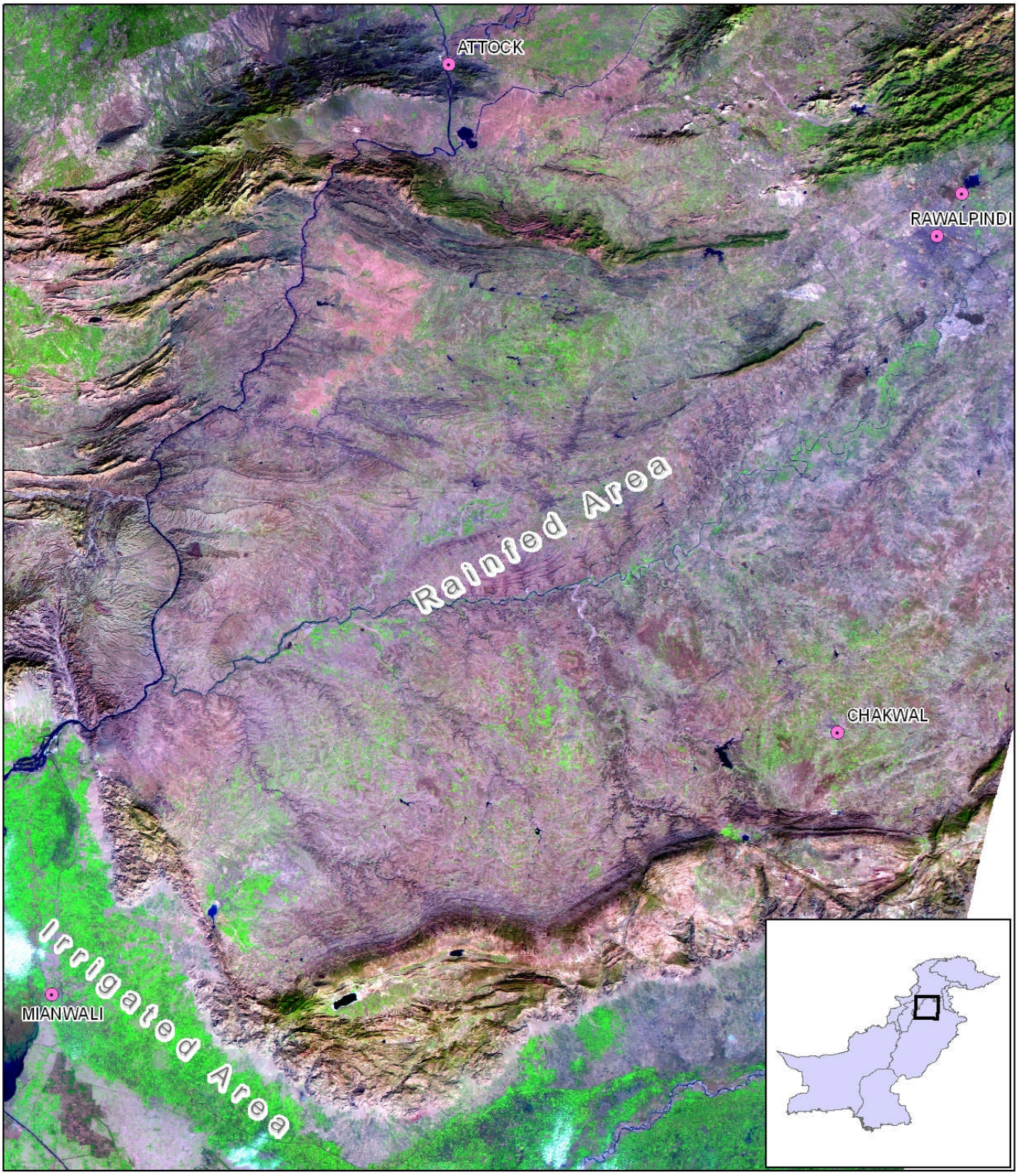
Rainfed Wheat Conditions, January 25, 2010



0 10 20 40
Kilometers

Data Source: AWiFS;
Pakistan Ministry of Food, Agriculture and Livestock
USDA-FAS, Office of Global Analysis - IPAD
Crop Explorer

FAS USDA

Figure 6. Crop status in major rainfed wheat area of Northern Punjub, January, 25, 2010. *Data Source: AWiFS*

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MODIS Imagery, Northern Punjab - N.W.F.P, February 20, 2009 and 2010

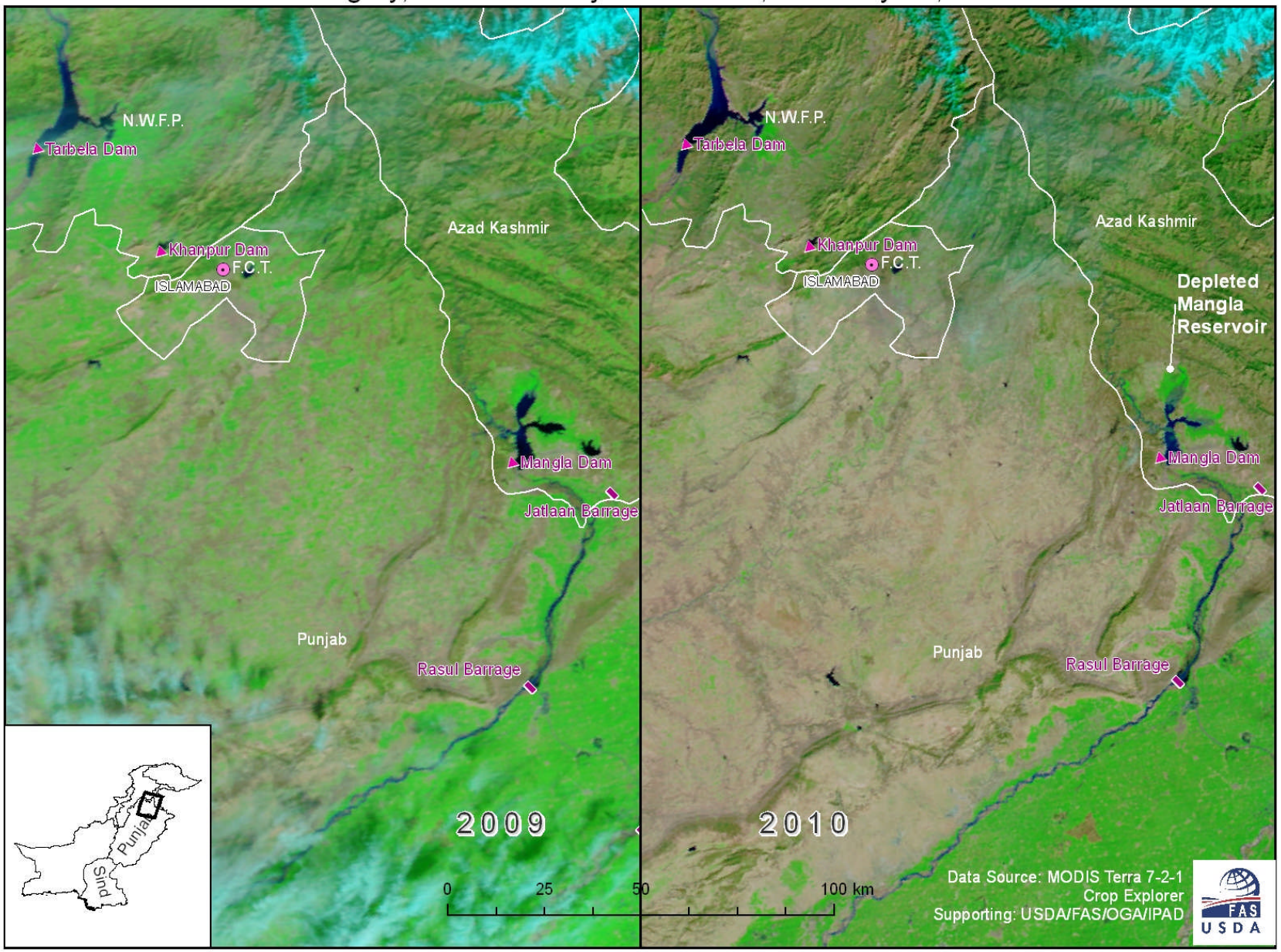

Figure 7. MODIS false color imagery over Northern Punjab and South-Central N.W.F.P., February 20, 2009 - 2010. *Data Source: MODIS*

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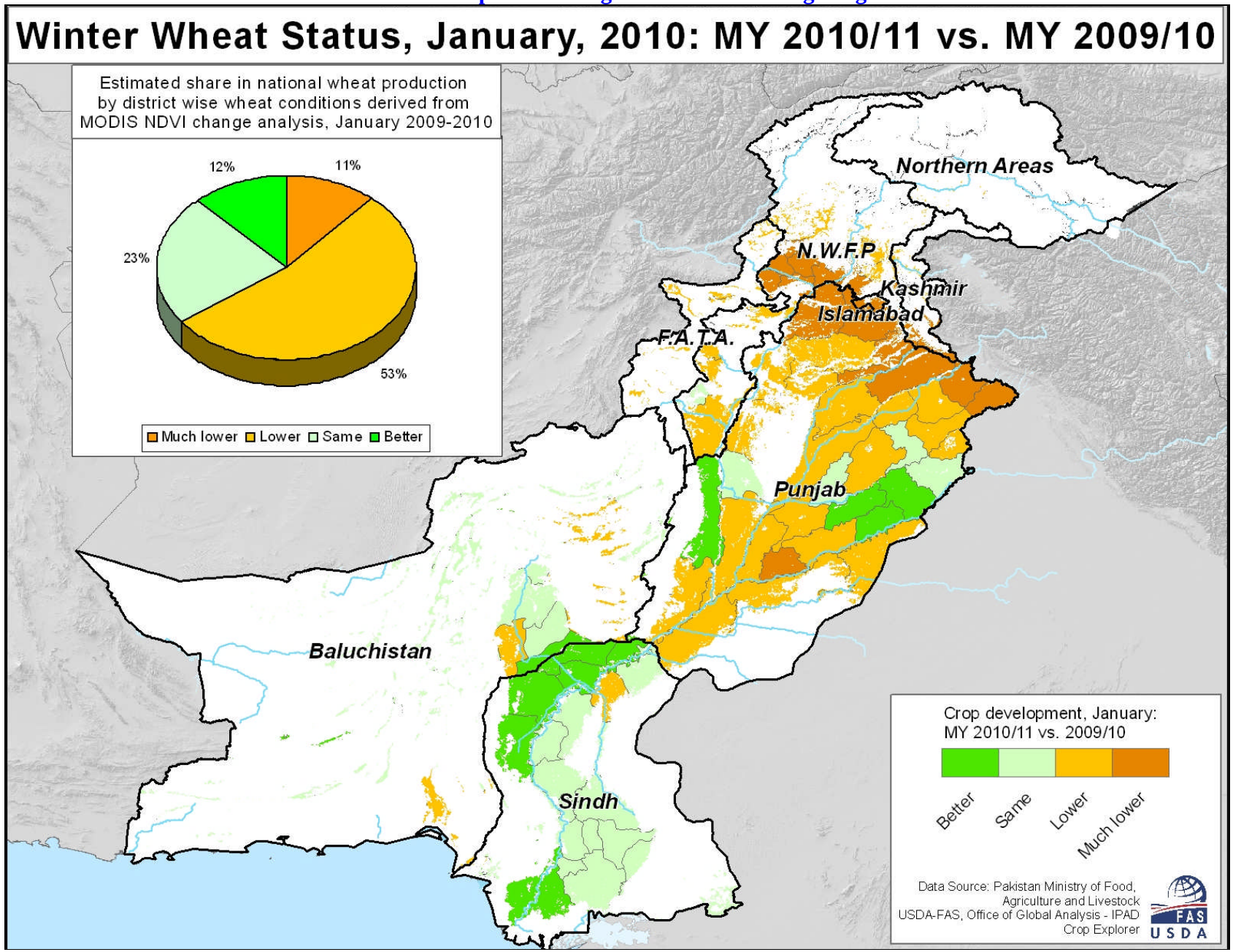

Figure 8. Estimated share in national production by zones delineated based on January 2010 and 2009 wheat conditions. *Data Source: MODIS NDVI*

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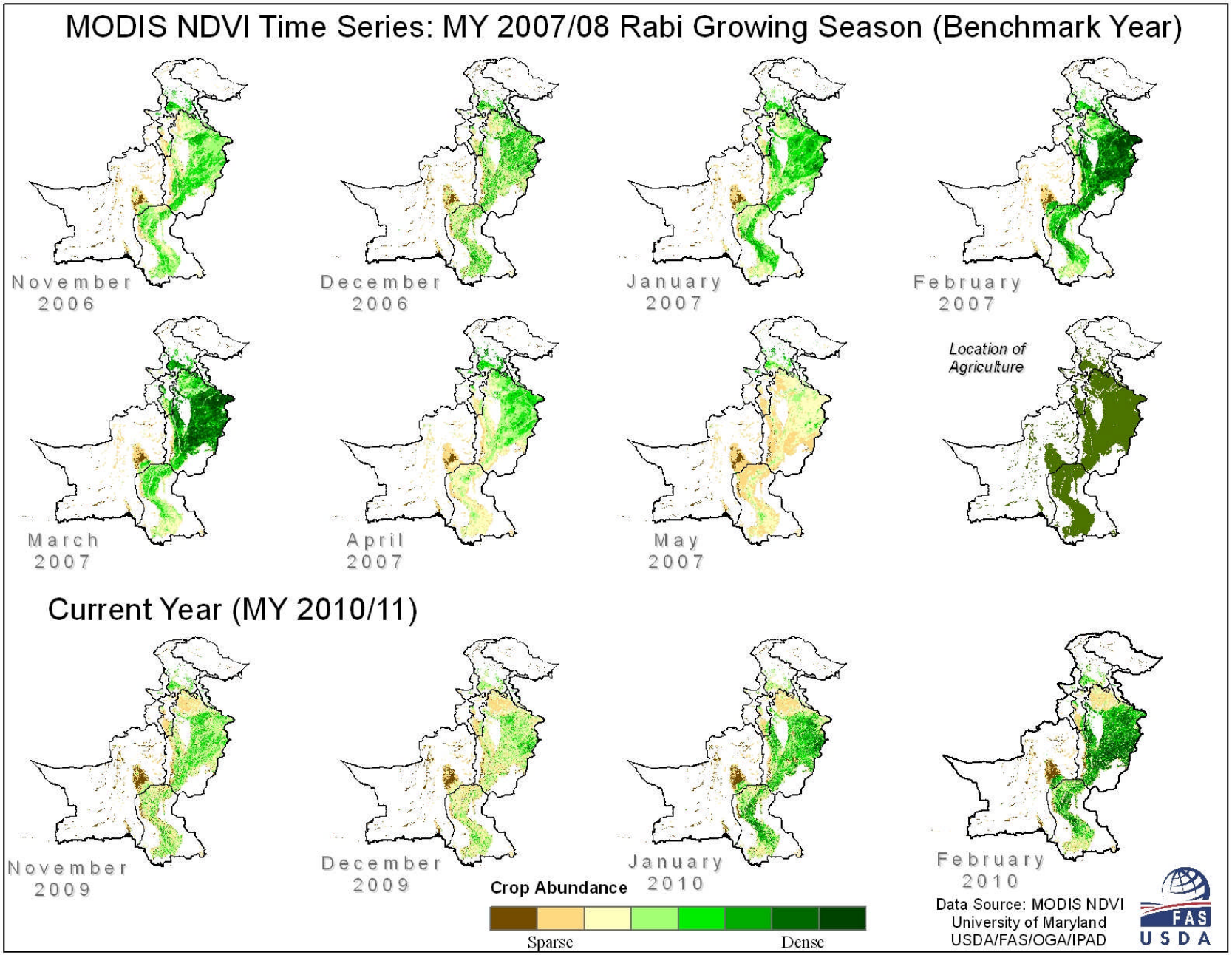

Figure 9. MODIS NDVI images over the winter grains season comparing MY 2006/07 benchmark grain production year to the current season. *Data Source: MODIS NDVI*

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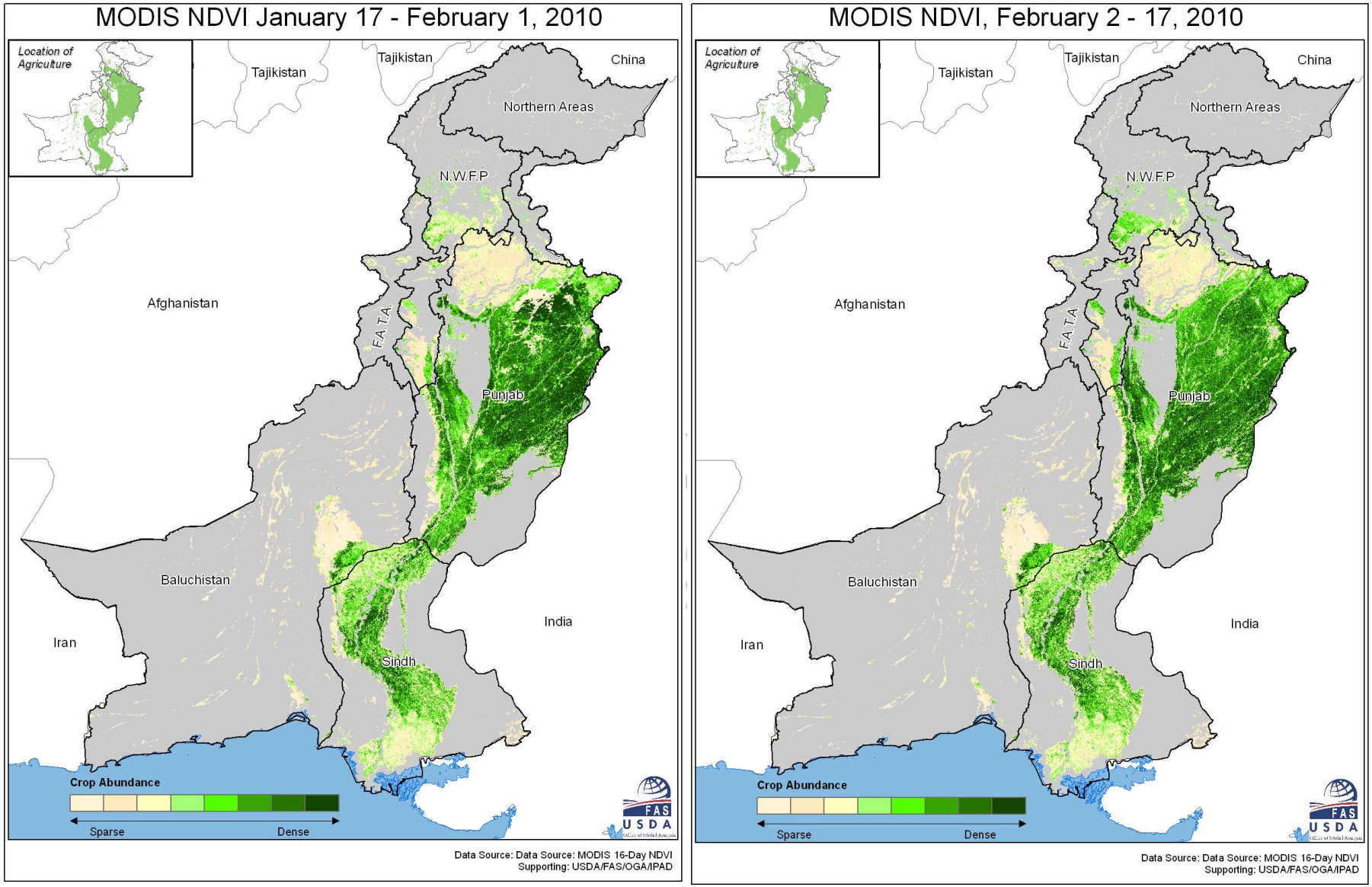

Figure 10. MODIS NDVI, January 17 – February 17, 2010. *Data Source: MODIS 16-Day NDVI*

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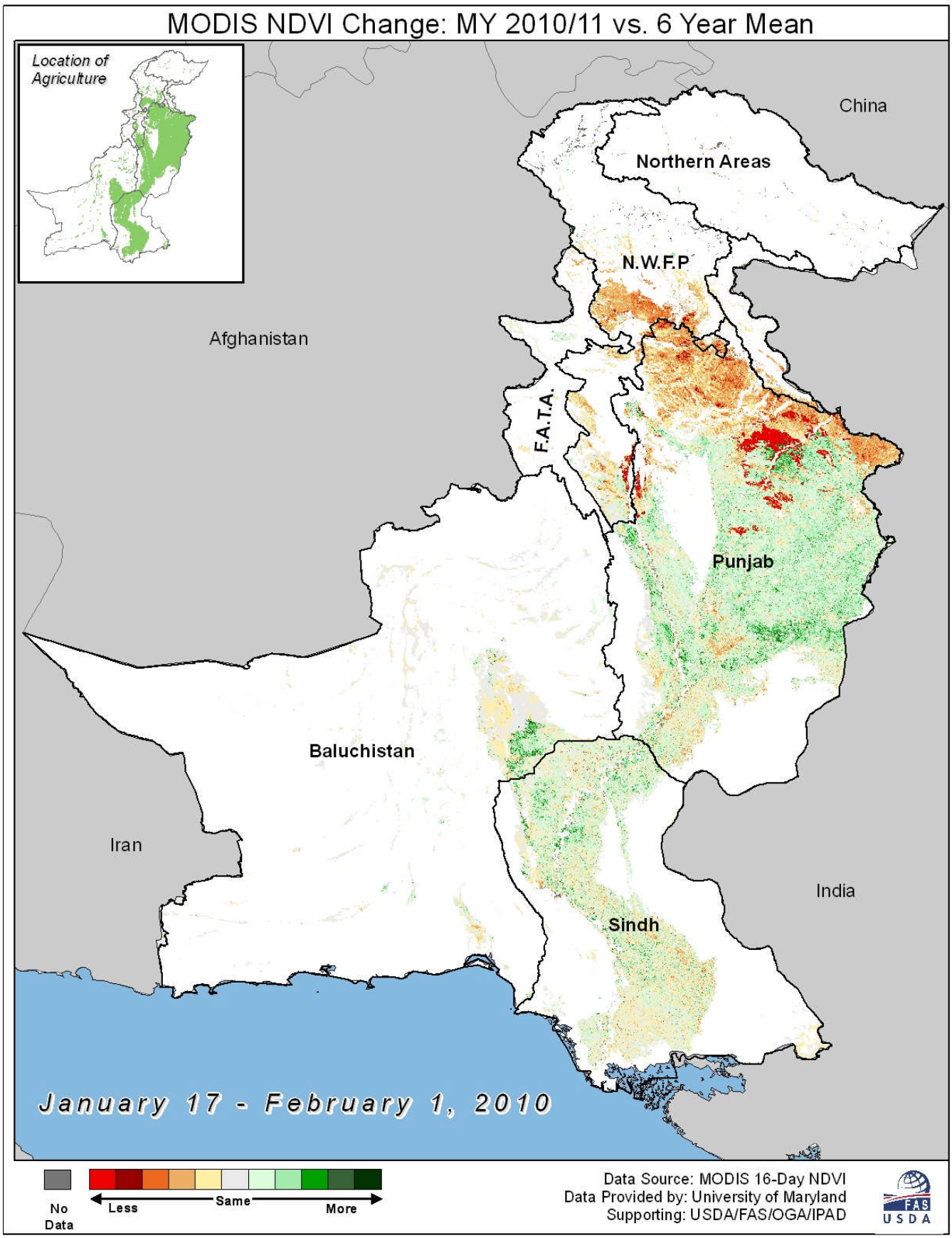

Figure 11. MODIS NDVI 6-yr anomaly, January 17 – February 1, 2010. *Data Source: MODIS 16-Day NDVI*

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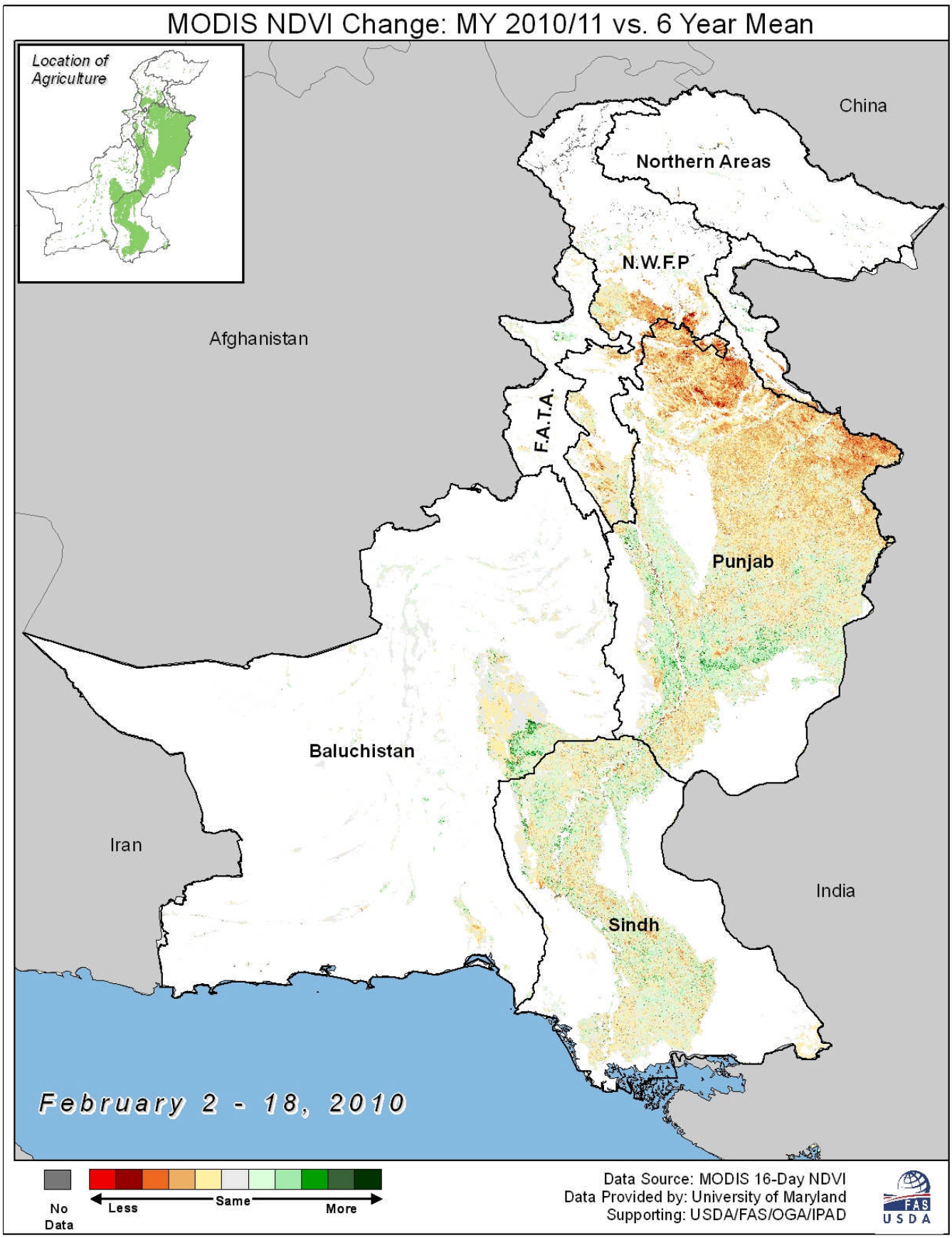

Figure 12. MODIS NDVI 6-yr anomaly, February 2 - 18, 2010. *Data Source: MODIS 16-Day NDVI*

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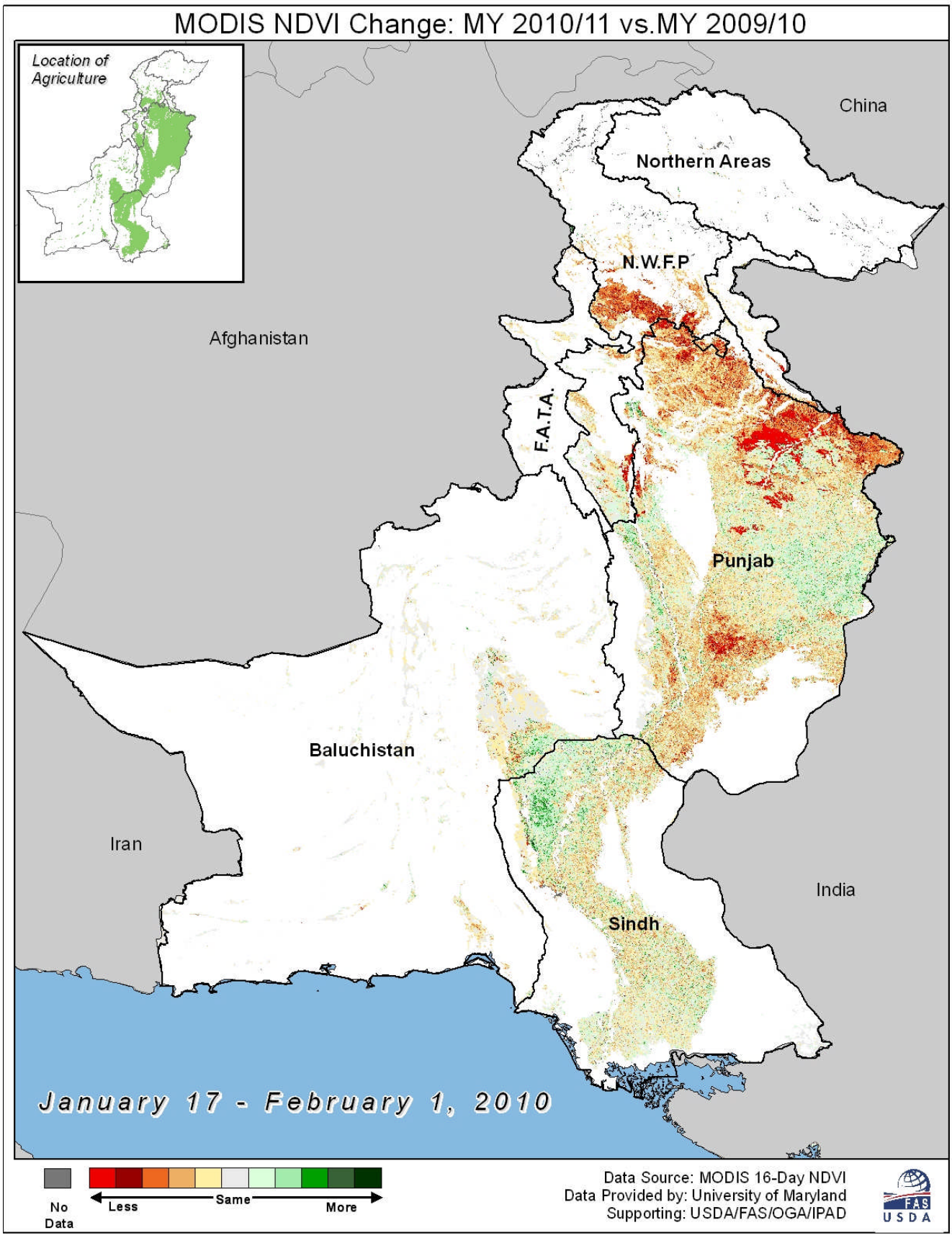

Figure 13. MODIS NDVI 1-yr anomaly, January 17 – February 1, 2010. *Data Source: MODIS 16-Day NDVI*

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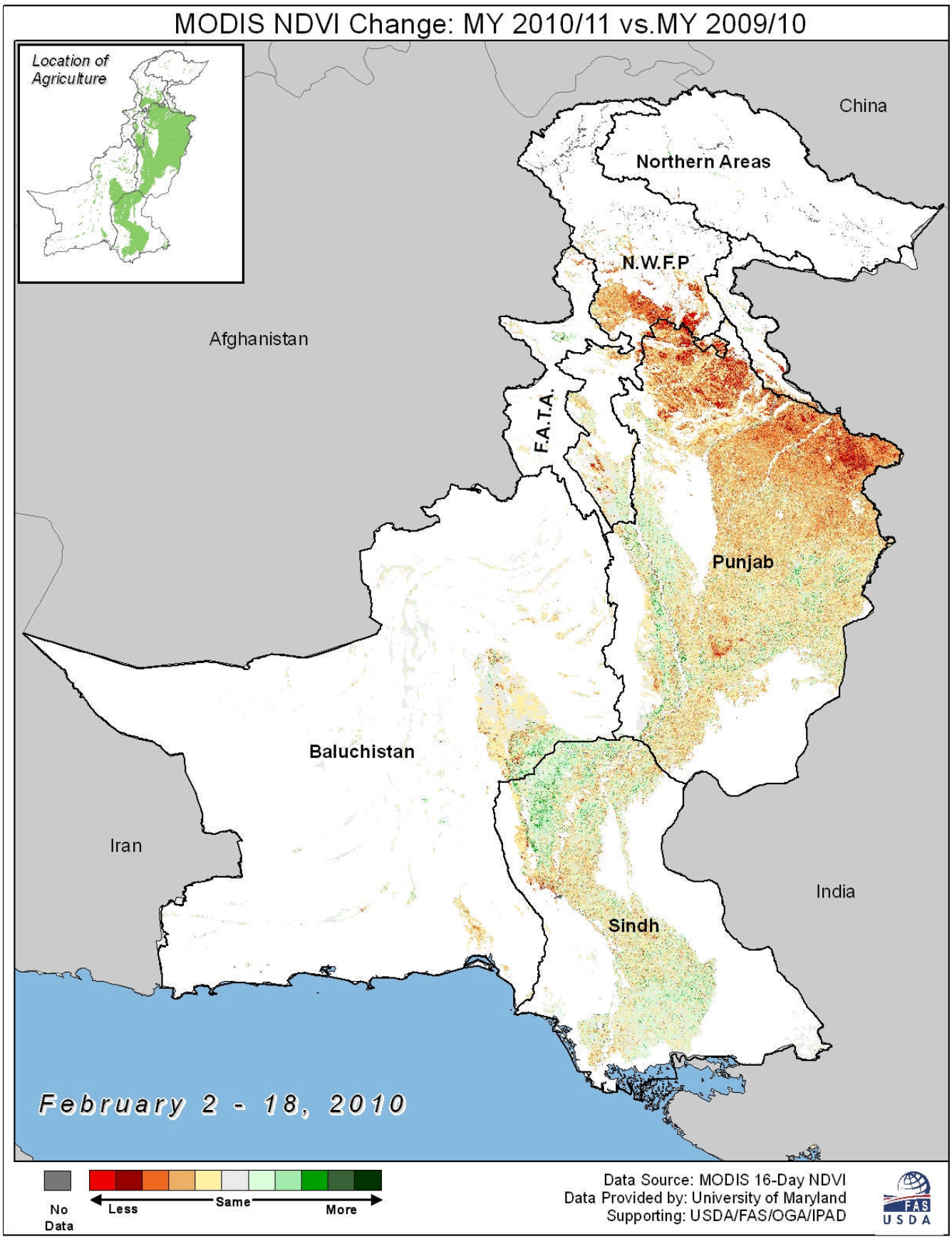

Figure 14. MODIS NDVI 1-yr anomaly, February 2 - 18, 2010. *Data Source: MODIS 16-Day NDVI*

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MODIS NDVI 1-yr and 6-yr anomaly local variations in rainfed wheat areas, February 1, 2010

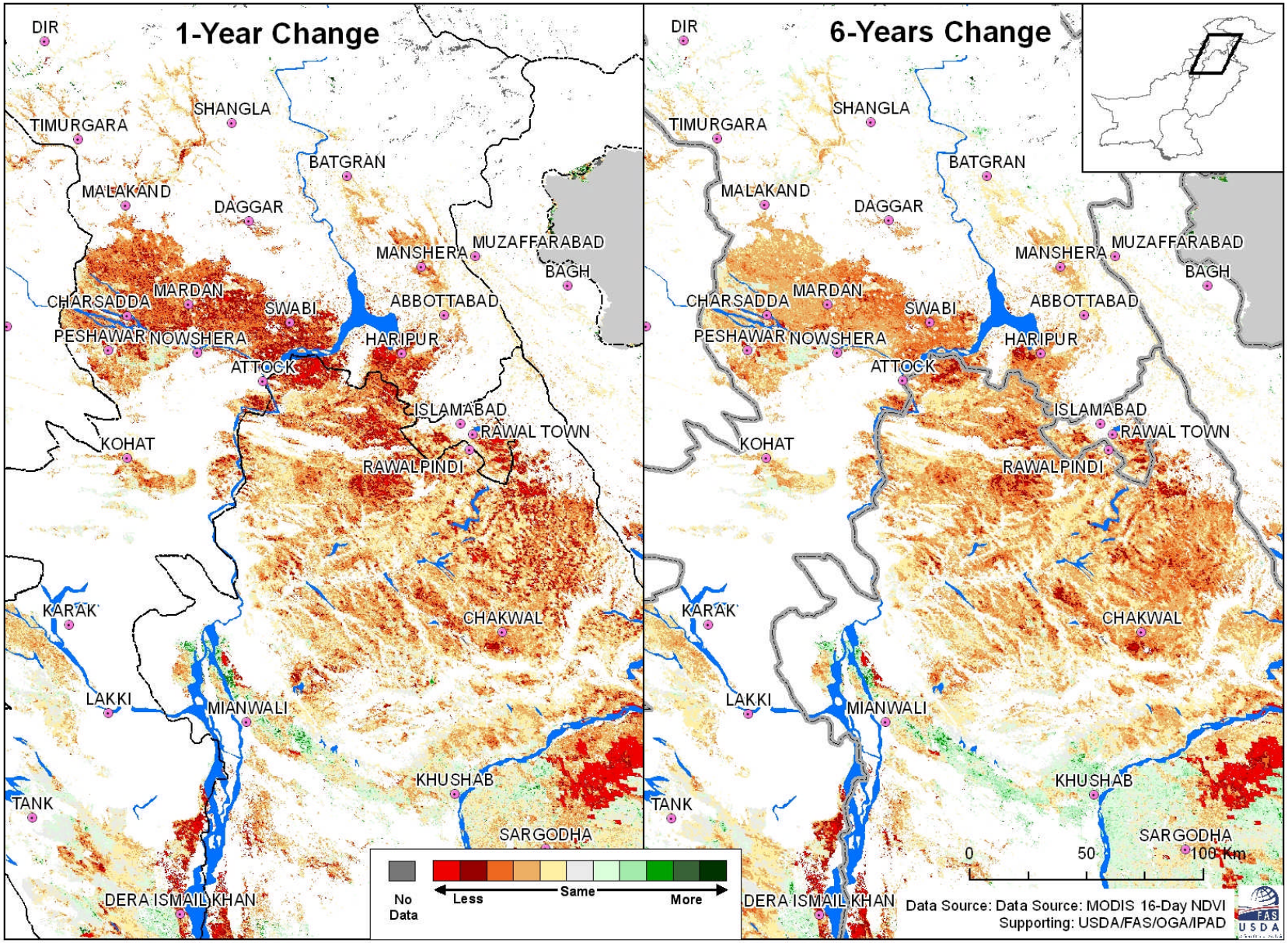

Figure 15. Change in MODIS NDVI for rainfed wheat area: MY 2010/11 vs. last year and 6-year average, January 17 – February 1, 2010. *Data Source: MODIS NDVI*

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MODIS NDVI 1-yr and 6-yr anomaly local variations in rainfed wheat areas, February 2-18, 2010

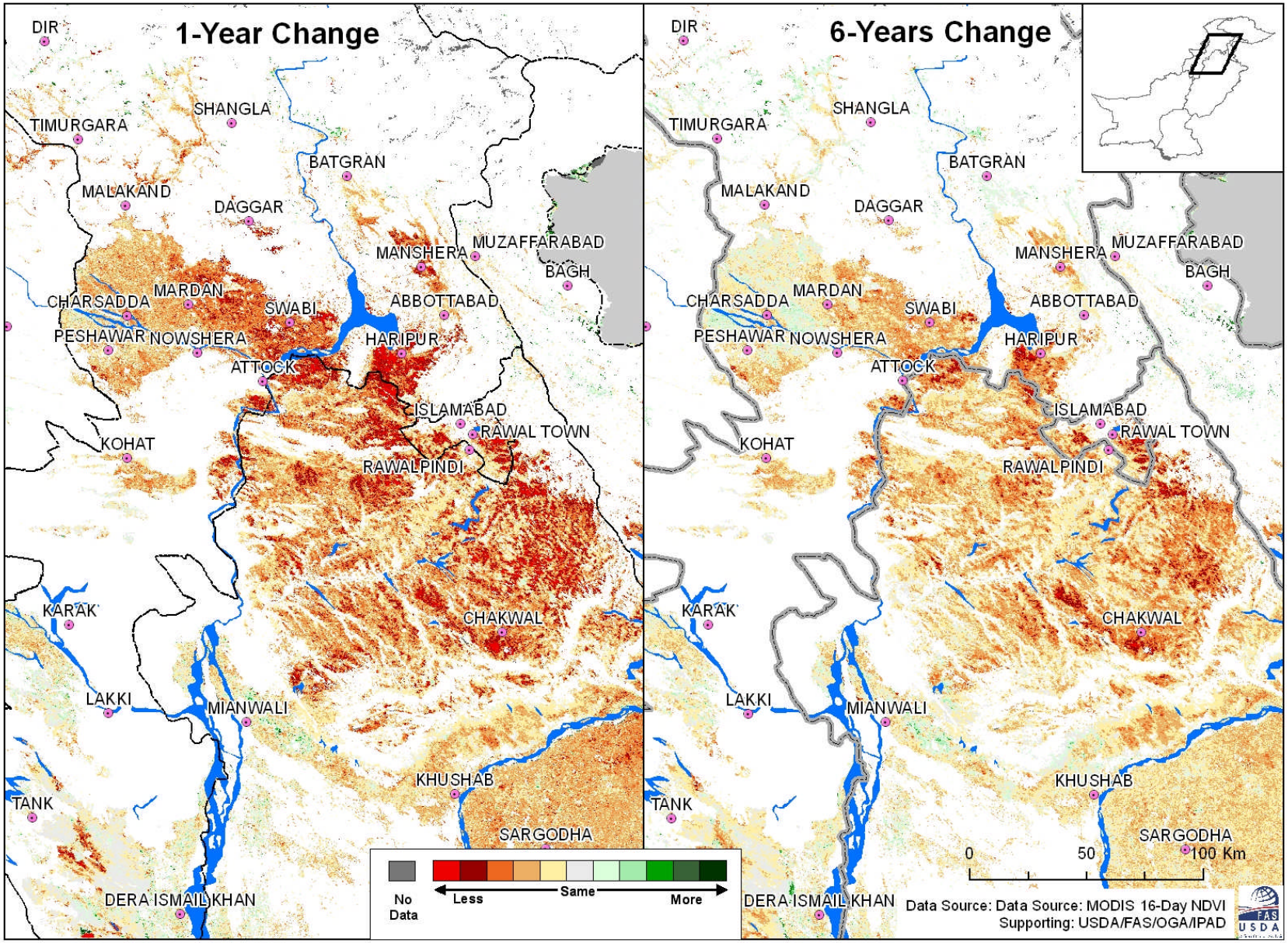

Figure 16. Change in MODIS NDVI for rainfed wheat area: MY 2010/11 vs. last year and 6-year average, February 2 - 18, 2010. *Data Source: MODIS NDVI*

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MODIS NDVI 1-yr and 6-yr anomaly local variations in Punjab, February 1, 2010

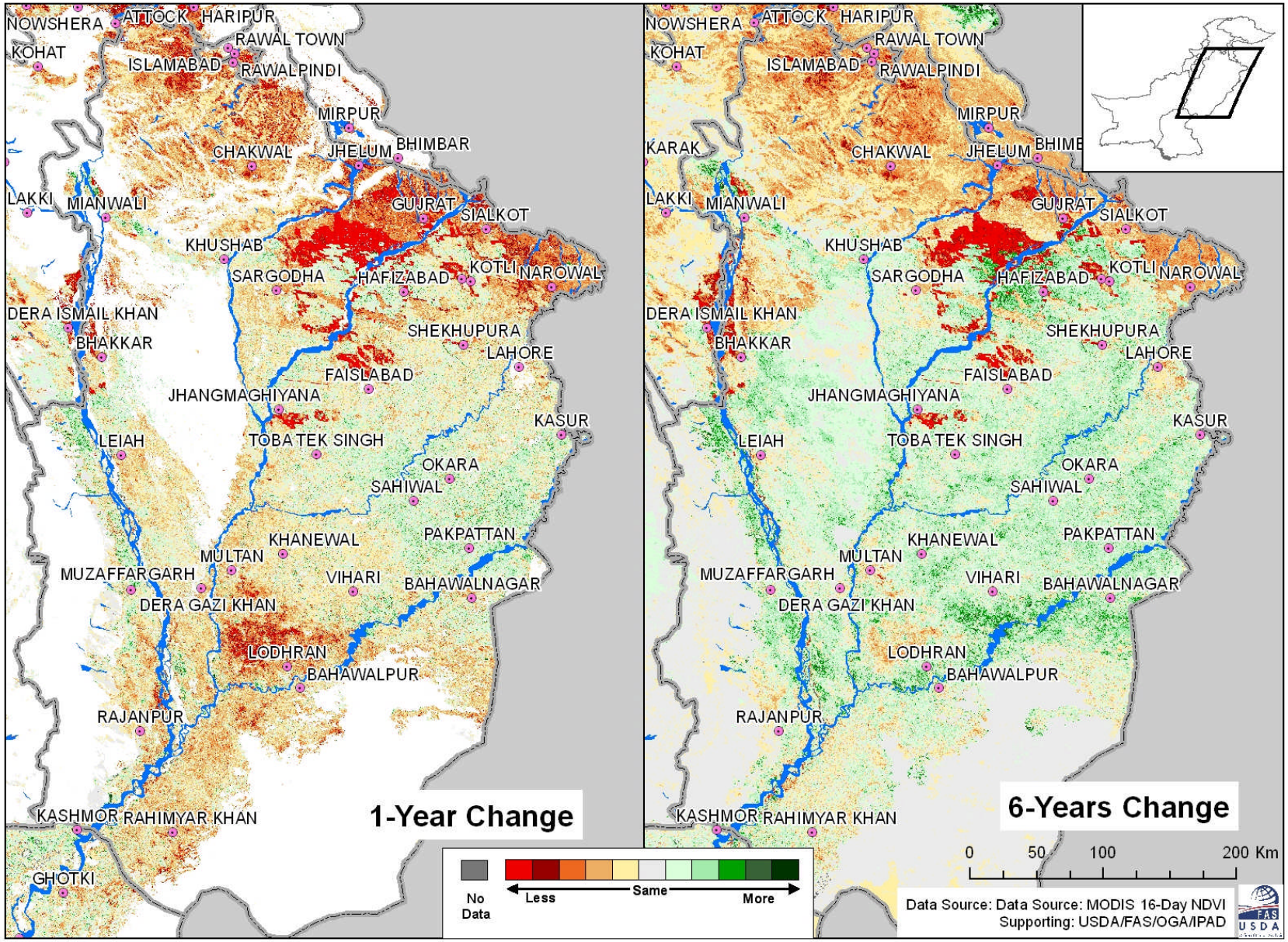

Figure 17. Change in MODIS NDVI in Punjab: MY 2010/11 vs. last year and 6-year average, January 17 – February 1, 2010. *Data Source: MODIS NDVI*

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MODIS NDVI 1-yr and 6-yr anomaly local variations in Punjab, February 2-18, 2010

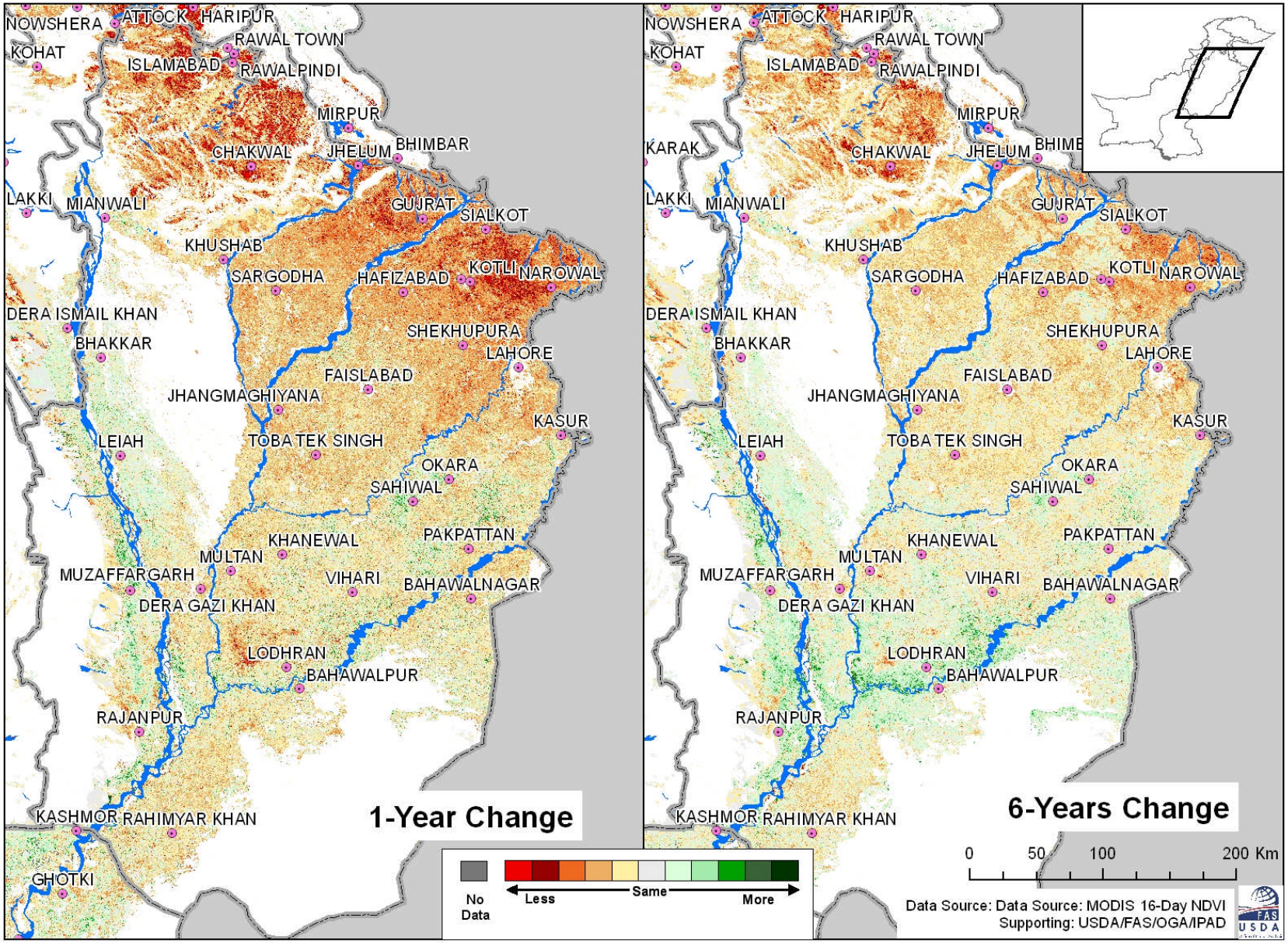

Figure 18. Change in MODIS NDVI in Punjab: MY 2010/11 vs. last year and 6-year average, February 2 - 18, 2010. *Data Source: MODIS NDVI*

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MODIS NDVI 1-yr and 6-yr anomaly local variations in Sindh, February 1, 2010

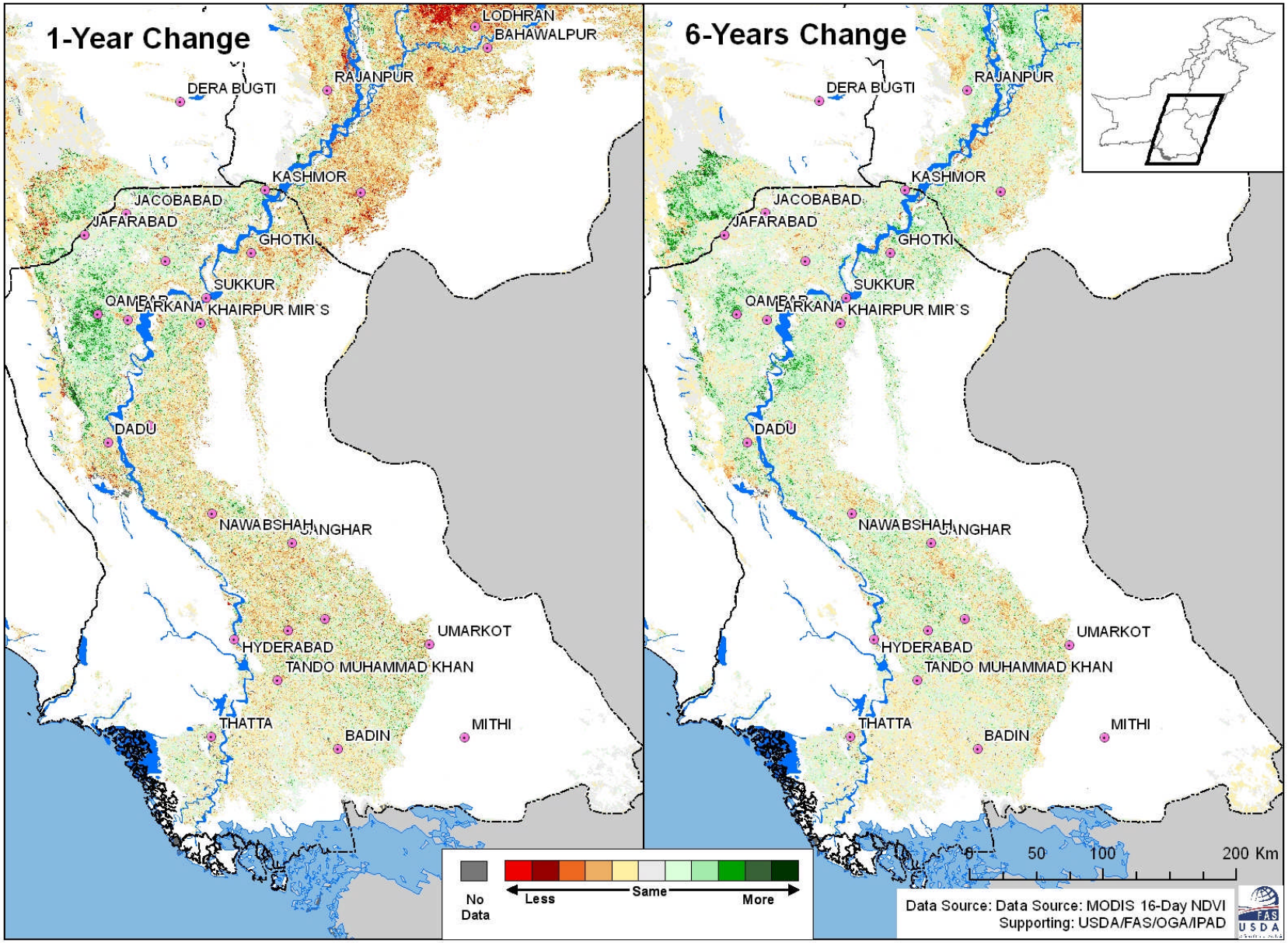

Figure 19. Change in MODIS NDVI in Sindh: MY 2010/11 vs. last year and 6-year average, January 17 – February 1, 2010. *Data Source: MODIS NDVI*

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MODIS NDVI 1-yr and 6-yr anomaly local variations in Sindh, February 2-18, 2010

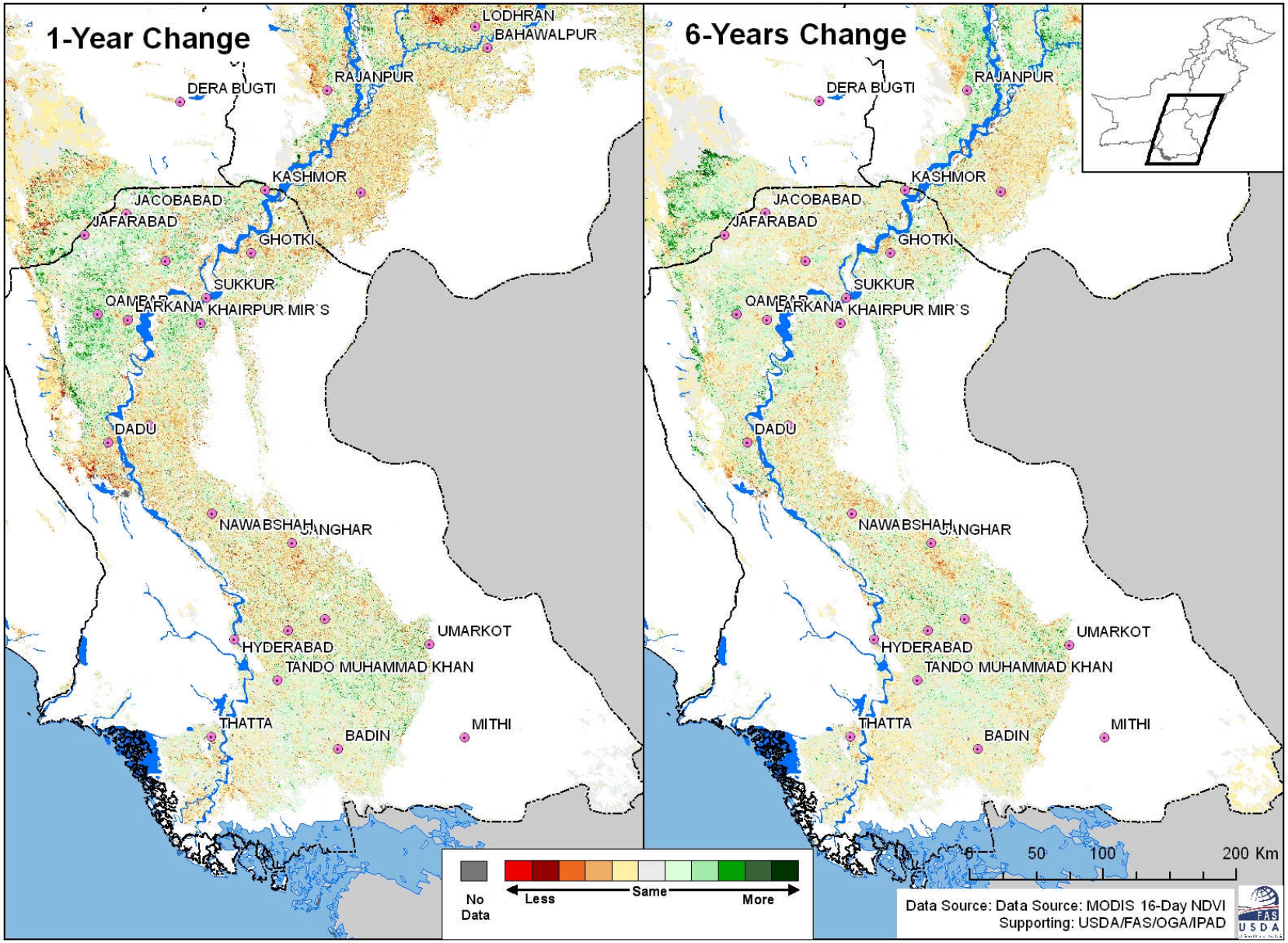

Figure 20. Change in MODIS NDVI in Sindh: MY 2010/11 vs. last year and 6-year average, February 2 - 18, 2010. *Data Source: MODIS NDVI*

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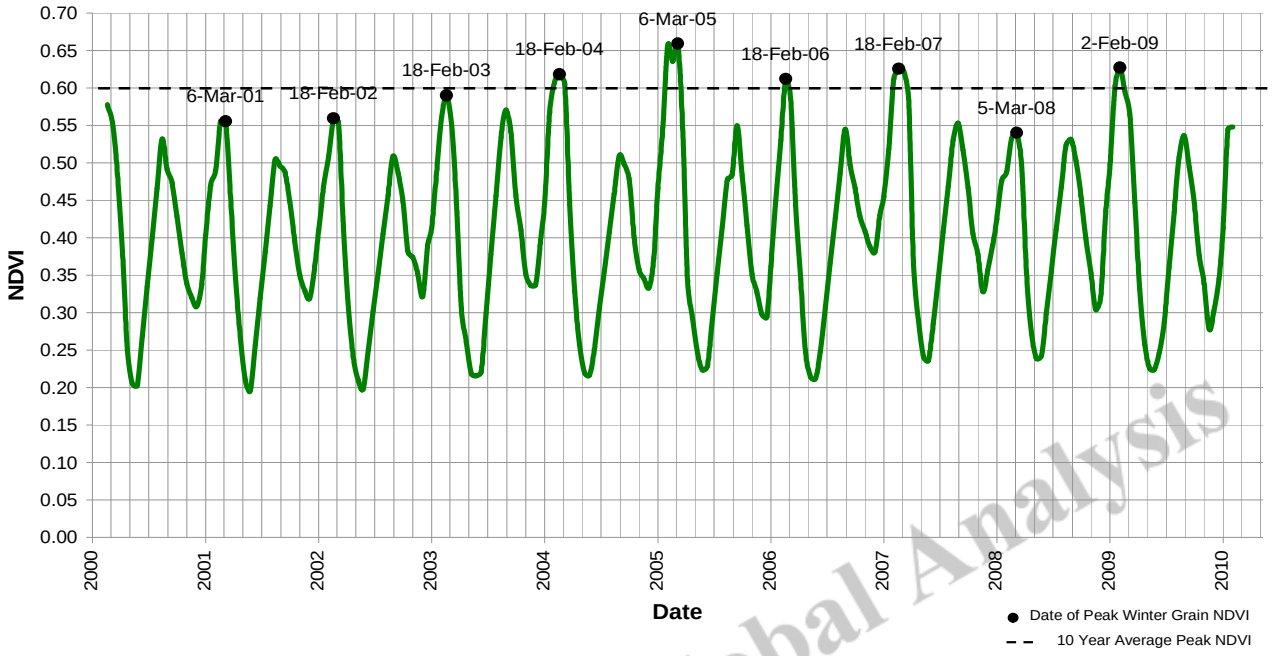
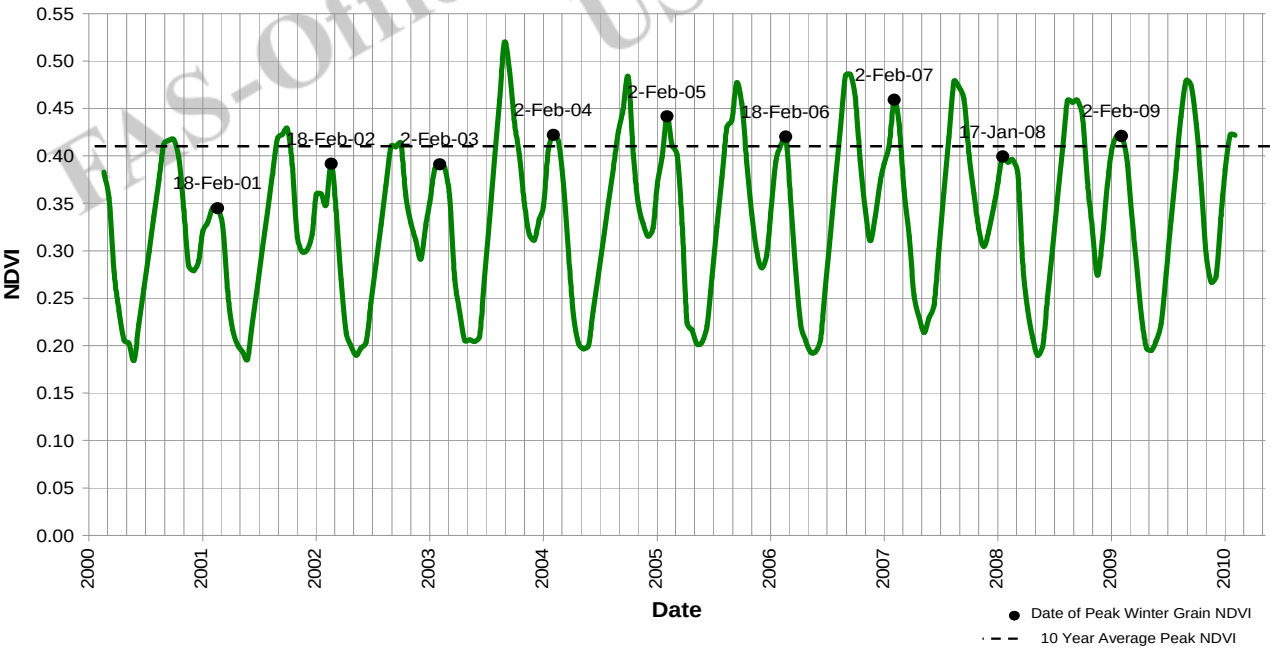
Punjab Agriculture NDVI Time Series



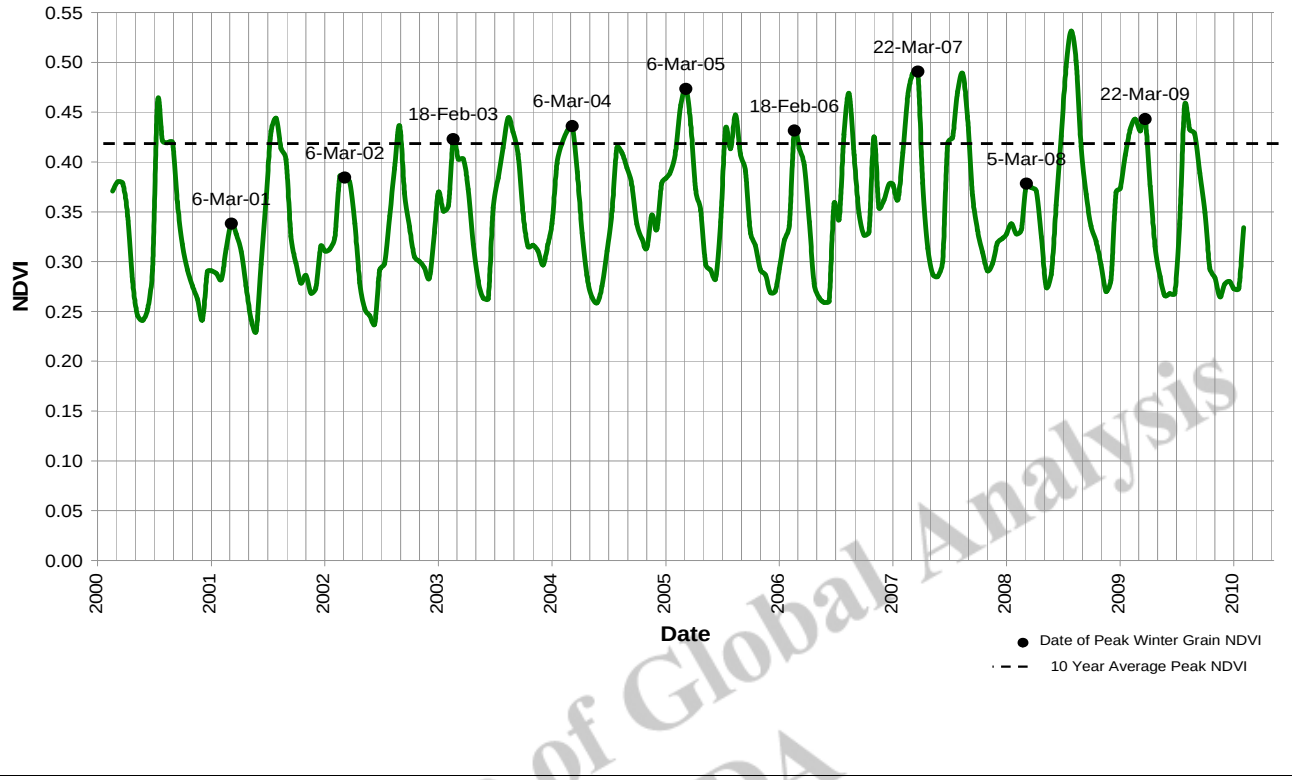
Punjab produces almost 77% of all wheat.

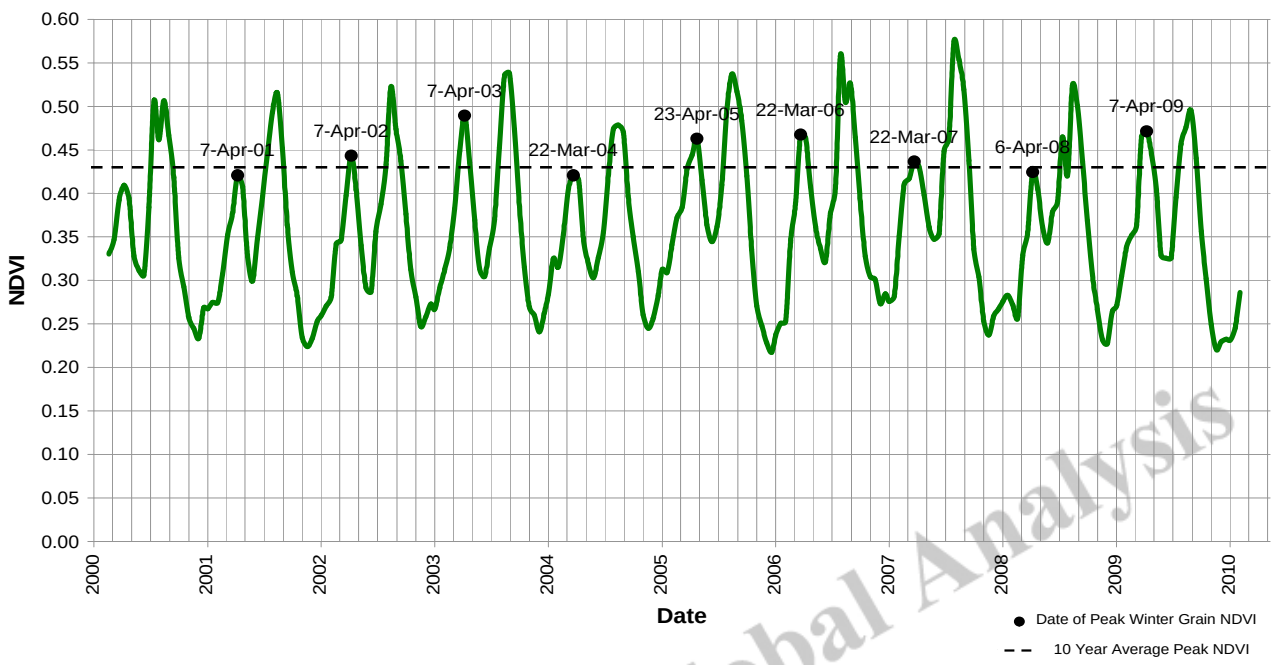
Sindh Agriculture NDVI Time Series



Sindh produces almost 15% of all wheat

Figure 21. NDVI time series over Punjab and Sindh Provinces, Pakistan.





N.W.F.P. and F.A.T.A. produce 5% of all wheat

Figure 22. NDVI time series over N.W.F.P. and F.A.T.A. Provinces, Pakistan.

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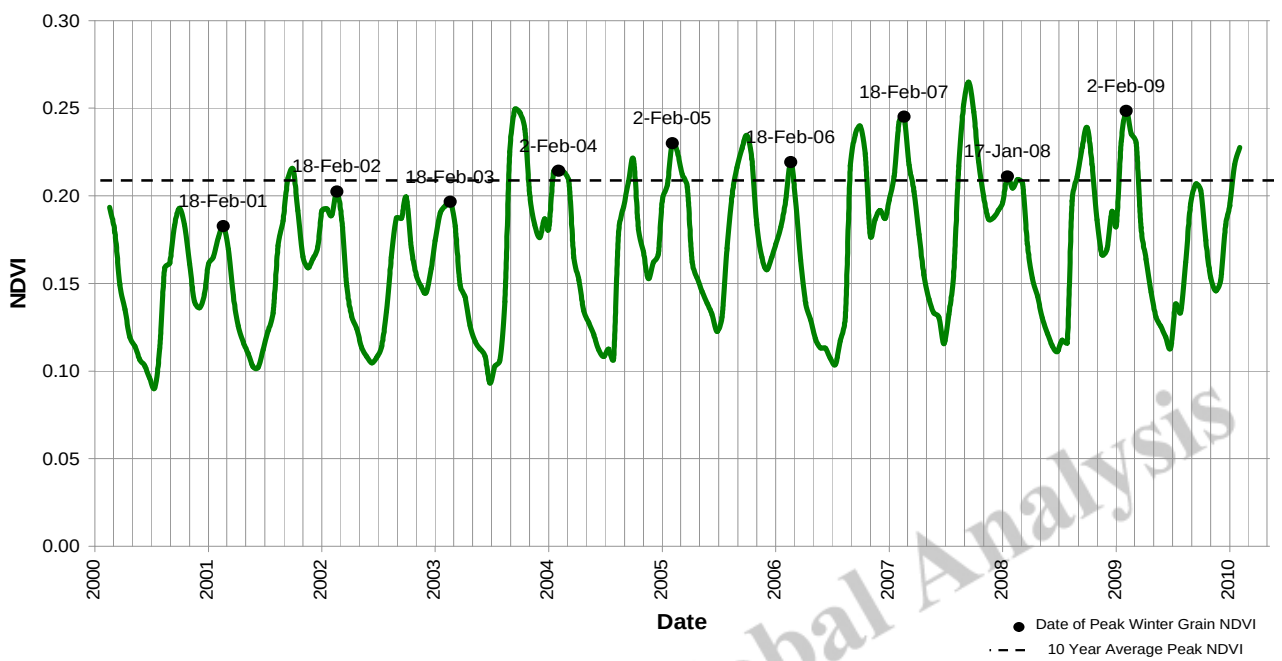
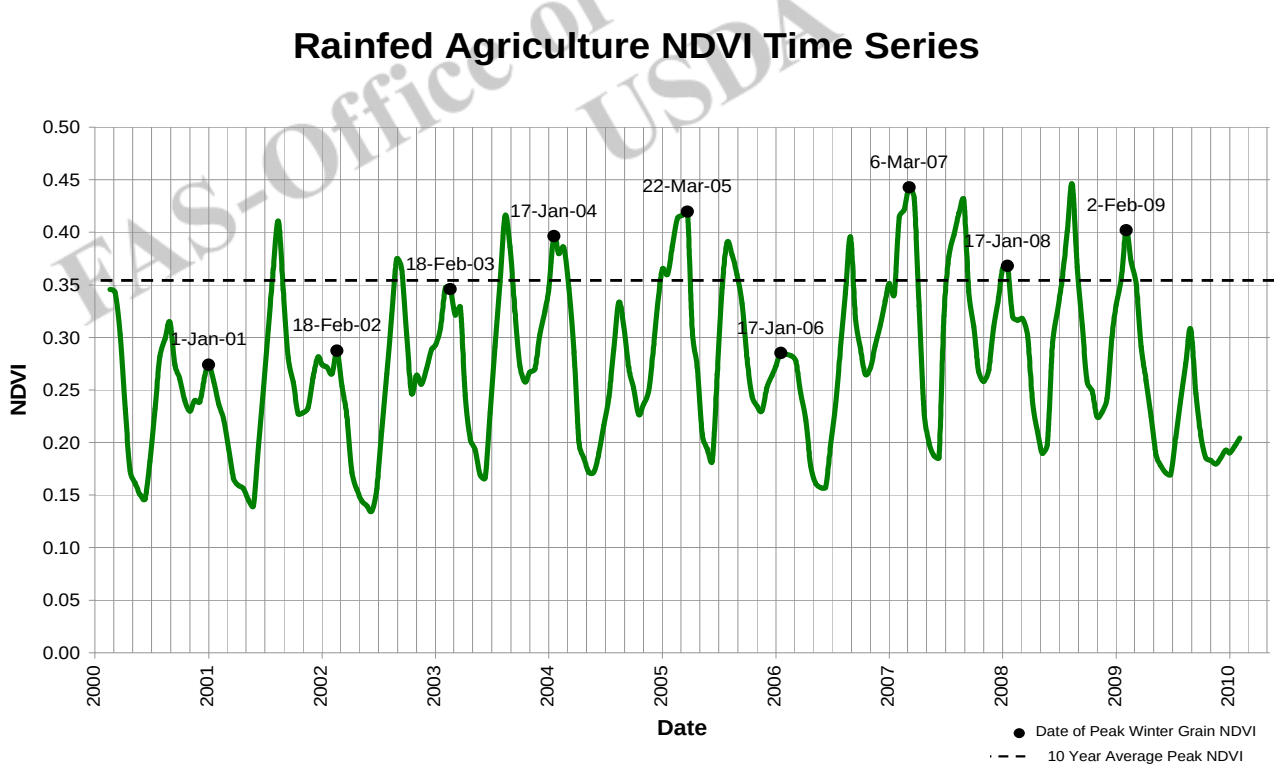


Baluchistan Province produces less than 4% of all wheat



Rainfed cropland, northern Punjab (see area map on Figure 6)

Figure 23. NDVI time series over Baluchistan Province and rainfed cropland in northern Punjab, Pakistan.

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Crop progress in Lower Indus Valley, Sindh, January 25 - February 3, 2010

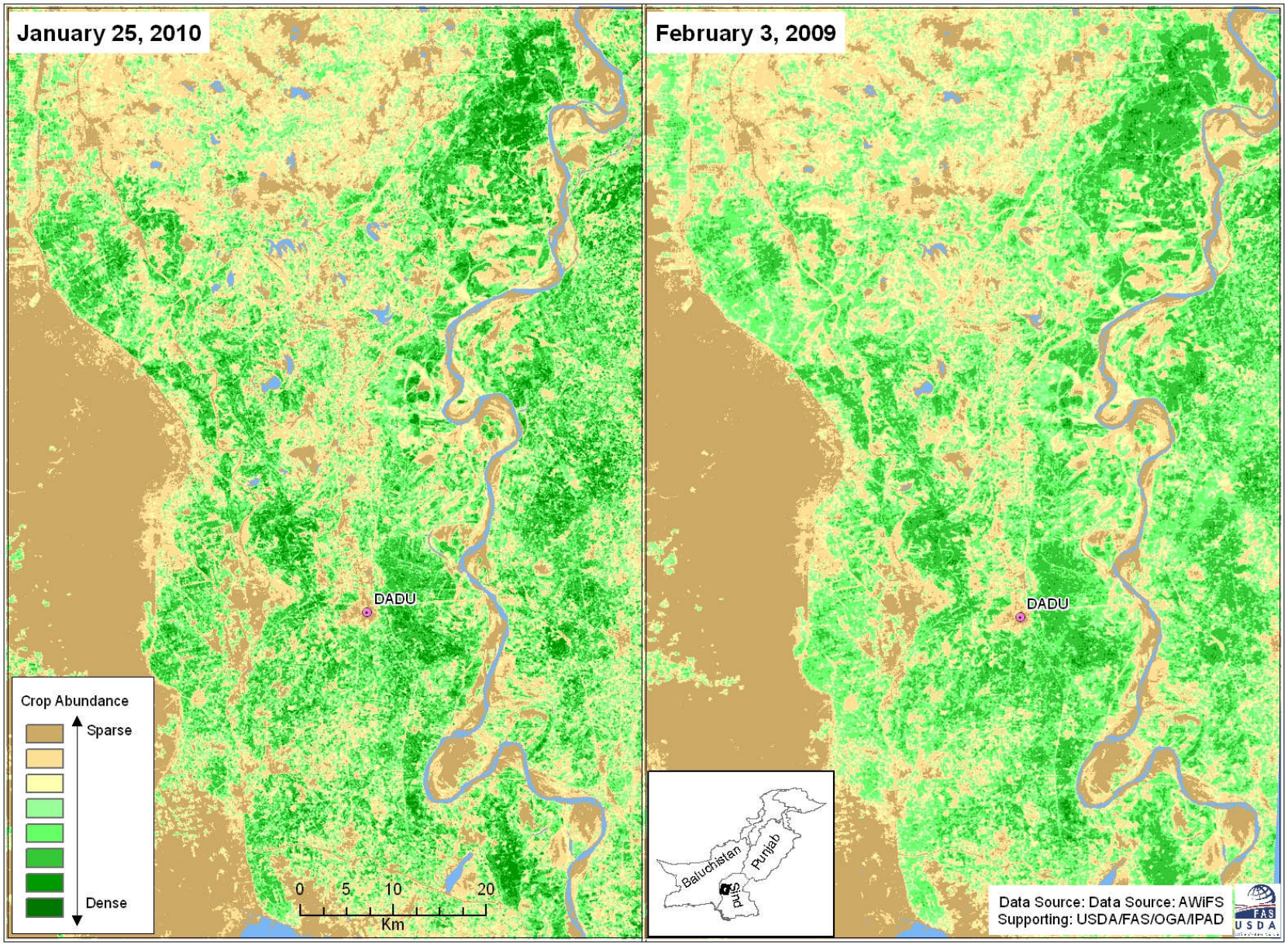

Figure 24. Peak vegetation development achieved in Lower Indus Valley, Sindh, January, 25 – February 3, 2010. *Data Source: AWiFS*

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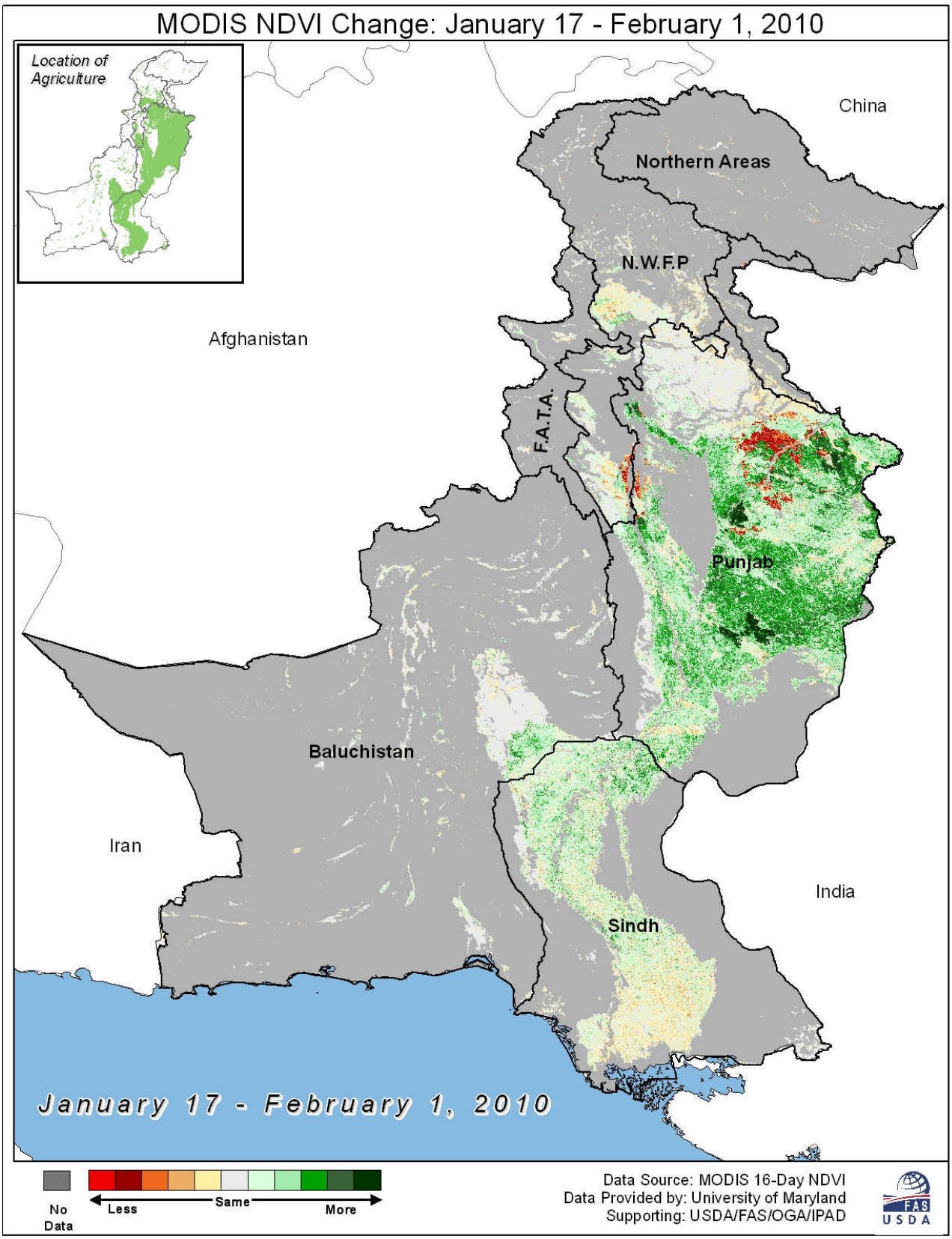

Figure 25. Change in MODIS NDVI, between January 17 and February 1, 2010. *Data Source: MODIS NDVI.*

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Depleted mid-season Chenab River flow in Punjab, 2010 compared to 2009.

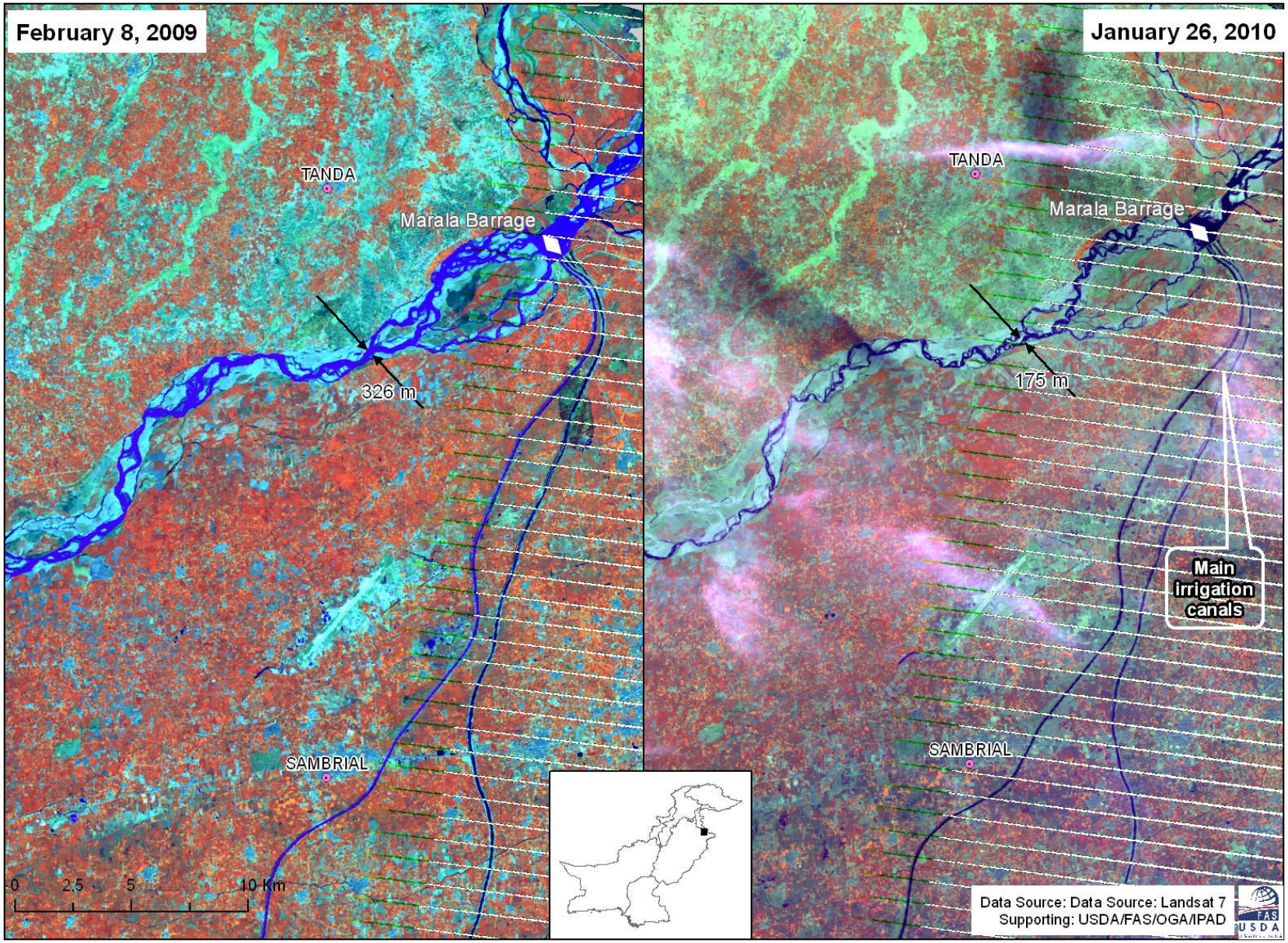

Figure 26. Depleted mid-season flow of the Chenab River below Marala barrage in Punjab, 2010 compared to 2009. *Data Source: Landsat* .

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Irrigated crop status along Chenab and Jhelum Rivers, Punjab, January 1 - February 2, 2010

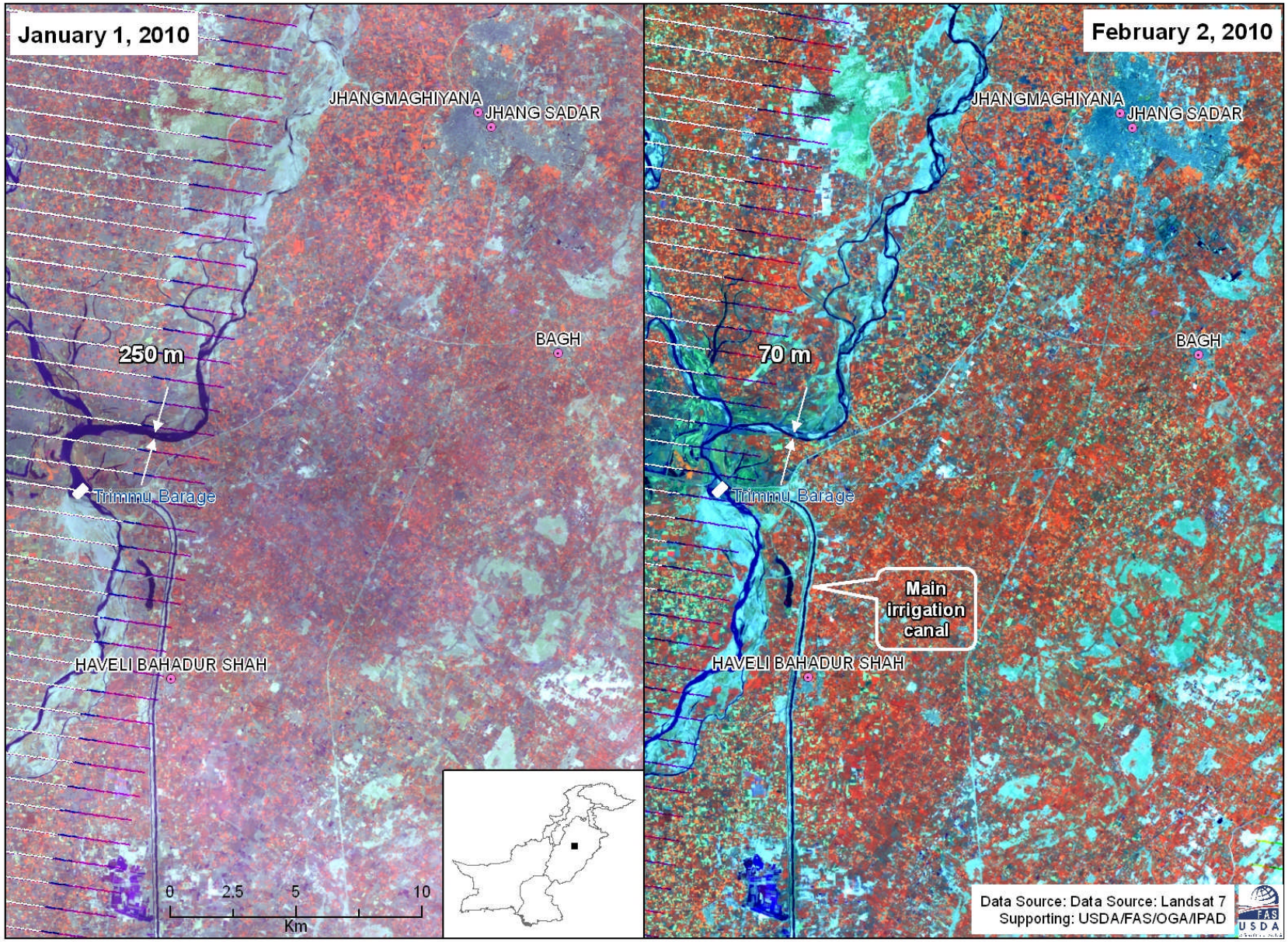

Figure 27. Crop progress in Lower Indus Valley and Indus River water level decline, January 1 – February 2, 2010. *Data Source: Landsat 7*

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Crop progress in Lower Indus Valley, Sindh, December 13, 2009 - January 25, 2010

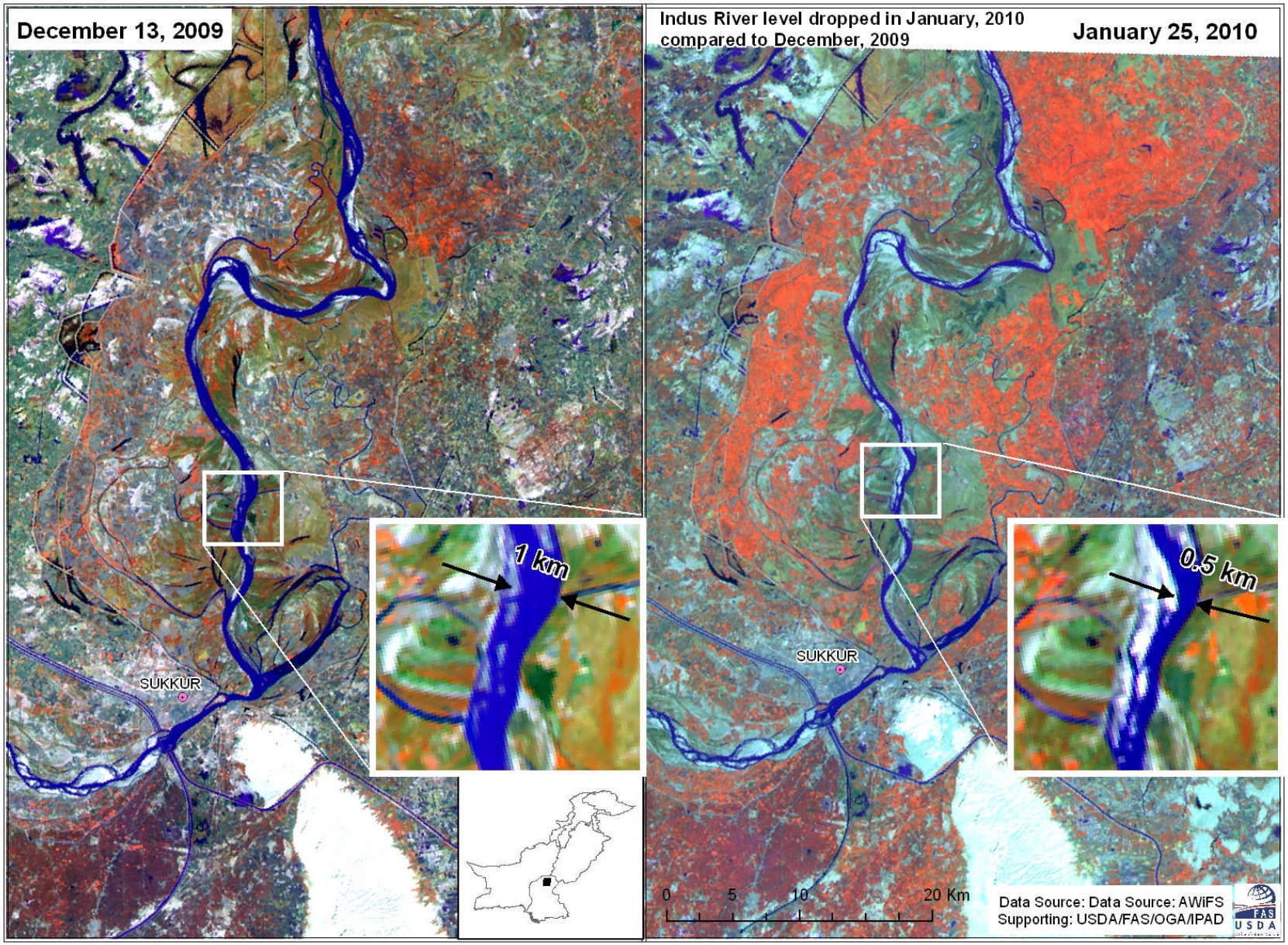

Figure 28. Crop progress in Lower Indus Valley and Indus River water level decline, December 13, 2009 – January 25, 2010. *Data Source: AWiFS*

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Crop progress in Lower Indus Valley, Sindh, January 25 - February 3, 2010

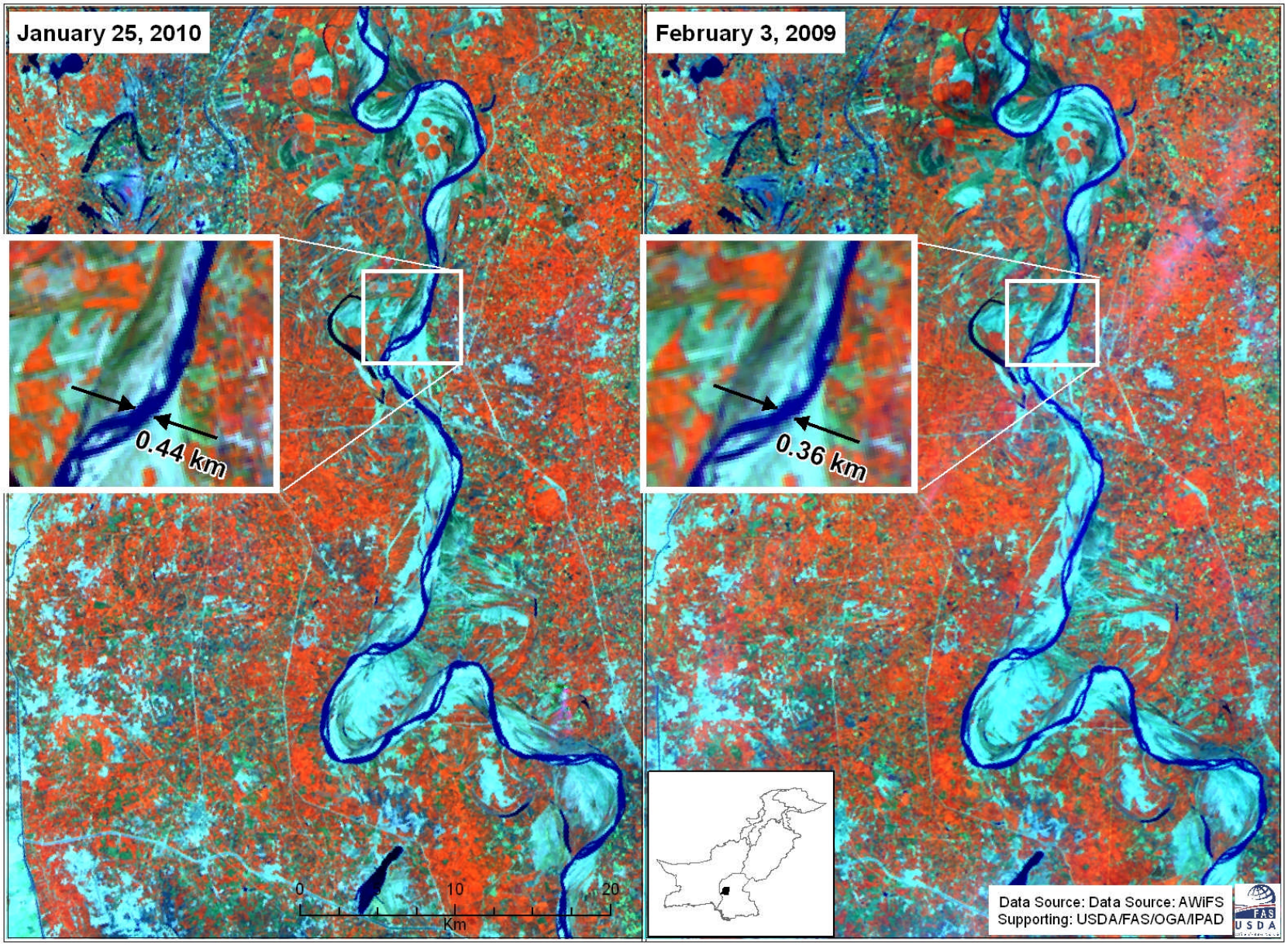

Figure 29. Crop progress in Lower Indus Valley and Indus River water level decline, January, 25 – February 3, 2010. *Data Source: AWiFS*

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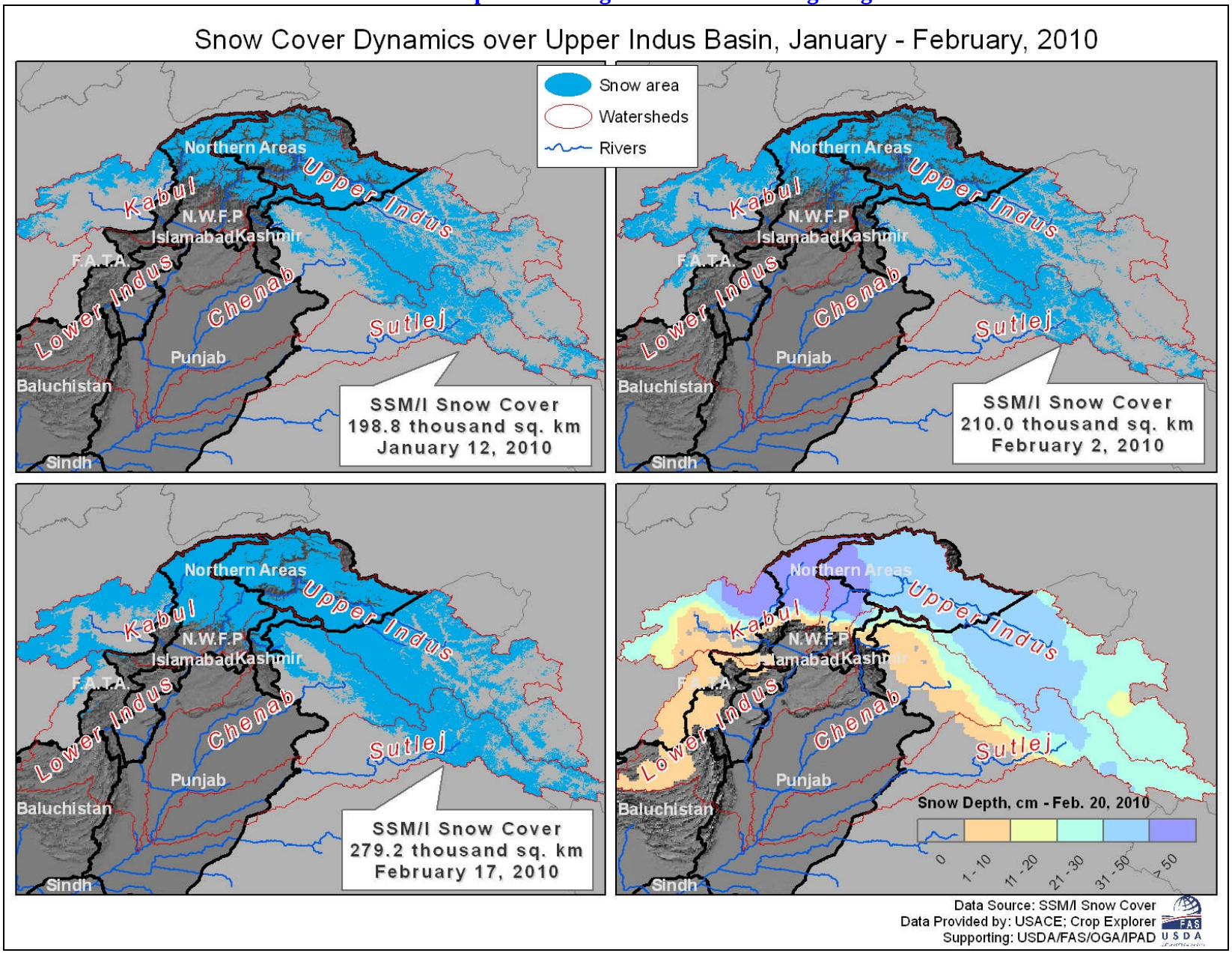

Figure 30. Upper Indus watershed snow cover in January - February, 2010. *Data Source: USACE. Note: Changes in snowpack properties, such as a rapid increase in average snow crystal size, can cause overestimation of snow water equivalent (SWE) volumes based on passive microwave data*

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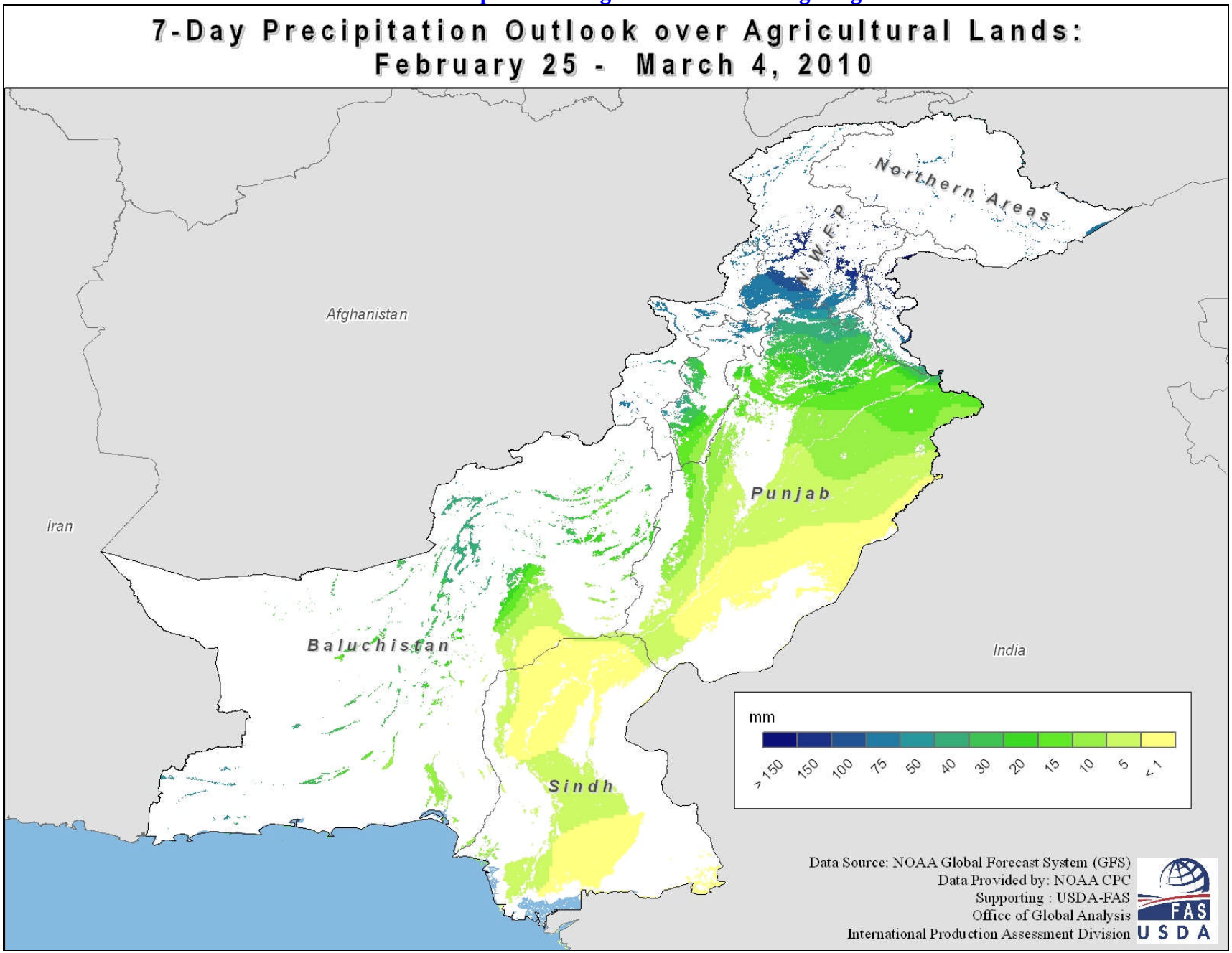

Figure 31. 7-Day Precipitation Outlook over Agricultural Lands: February 24 - March 3, 2010. *Data Source: NOAA CPC*

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APPENDIX

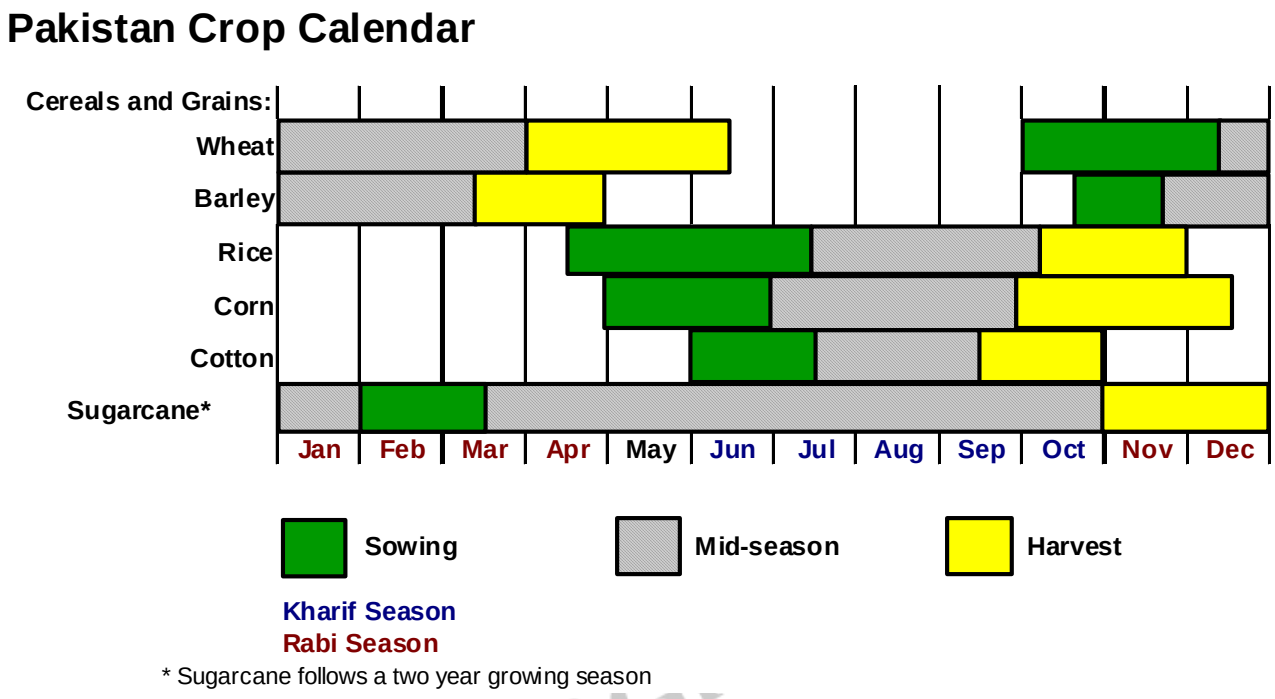

Figure A1. Pakistan crop calendar highlighting major crops grown during Rabi (Nov. – Apr.) and Kharif (June – Oct.) growing seasons. Calendar represents major production regions, timing of planting and harvest may vary regionally.

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Table A1. Pakistan area and production of wheat crop, 2007 – 2009. *Data Source: Pakistan Ministry of food, Agriculture and Livestock.*

			2006-07			2007-08			2008-09
Production, 1,000 MT	Irrigated	Rainfed	Total	Irrigated	Rainfed	Total	Irrigated	Rainfed	Total
Pakistan, all	**21,390**	**1,905**	**23,295**	**19,634**	**1,325**	**20,959**	**22,411**	**1,622**	**24,033**
Punjab	16607.5	1245.5	17853.0	14812.4	794.6	15607.0	17406.06	1013.94	18420.00
Sindh	3331.6	77.6	3409.2	3382.5	28.9	3411.4	3508.08	32.10	3540.18
NWFP & FATA	633.8	526.6	1160.4	634.4	437.4	1071.8	689.80	514.69	1204.49
Baluchistan	816.7	55.4	872.1	804.9	63.7	868.6	806.63	61.58	868.21
Top10 Rainfed Districts	827	1,225	2,053	828	800	1,628	866	1,051	1,694
Top 10 Irrigated Districts	8,279	61	8,340	7,094	52	7,146	8,490	48	8,537
Area, 1,000 ha	Irrigated	Rainfed	Total	Irrigated	Rainfed	Total	Irrigated	Rainfed	Total
Pakistan, all	**7,335**	**1,244**	**8,578**	**7,370**	**1,180**	**8,550**	**7,821**	**1,225**	**9,046**
Punjab	5723.0	709.8	6432.8	5742.4	659.6	6402.0	6144.23	692.00	6836.23
Sindh	937.0	45.2	982.2	951.3	38.6	989.9	990.53	40.88	1031.41
NWFP & FATA	314.0	440.3	754.3	322.4	425.0	747.4	331.40	438.11	769.51
Baluchistan	360.6	48.3	408.9	354.1	56.4	410.5	355.00	54.05	408.93
Top10 Rainfed Districts	340	701	1,041	372	650	1,022	383	688	1,071
Top 10 Irrigated Districts	2,718	32	2,750	2,667	34	2,701	2,885	48	2,933

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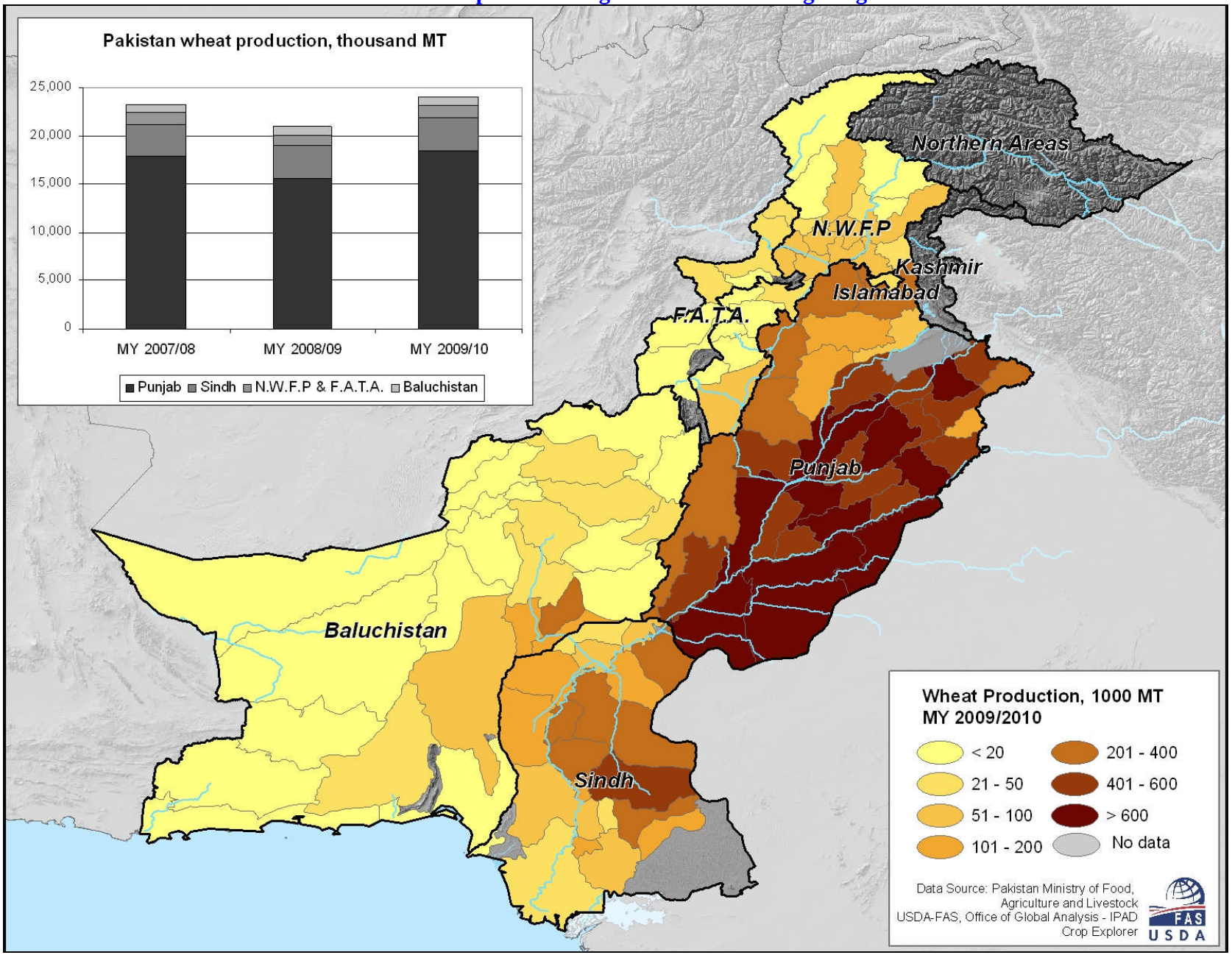

Figure A2. Provincial and district-wise distribution of wheat production in Pakistan in MY 2007 – 2010.

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Crop progress in Kurram River valley, N.W.F.P., December, 2009 - January, 2010

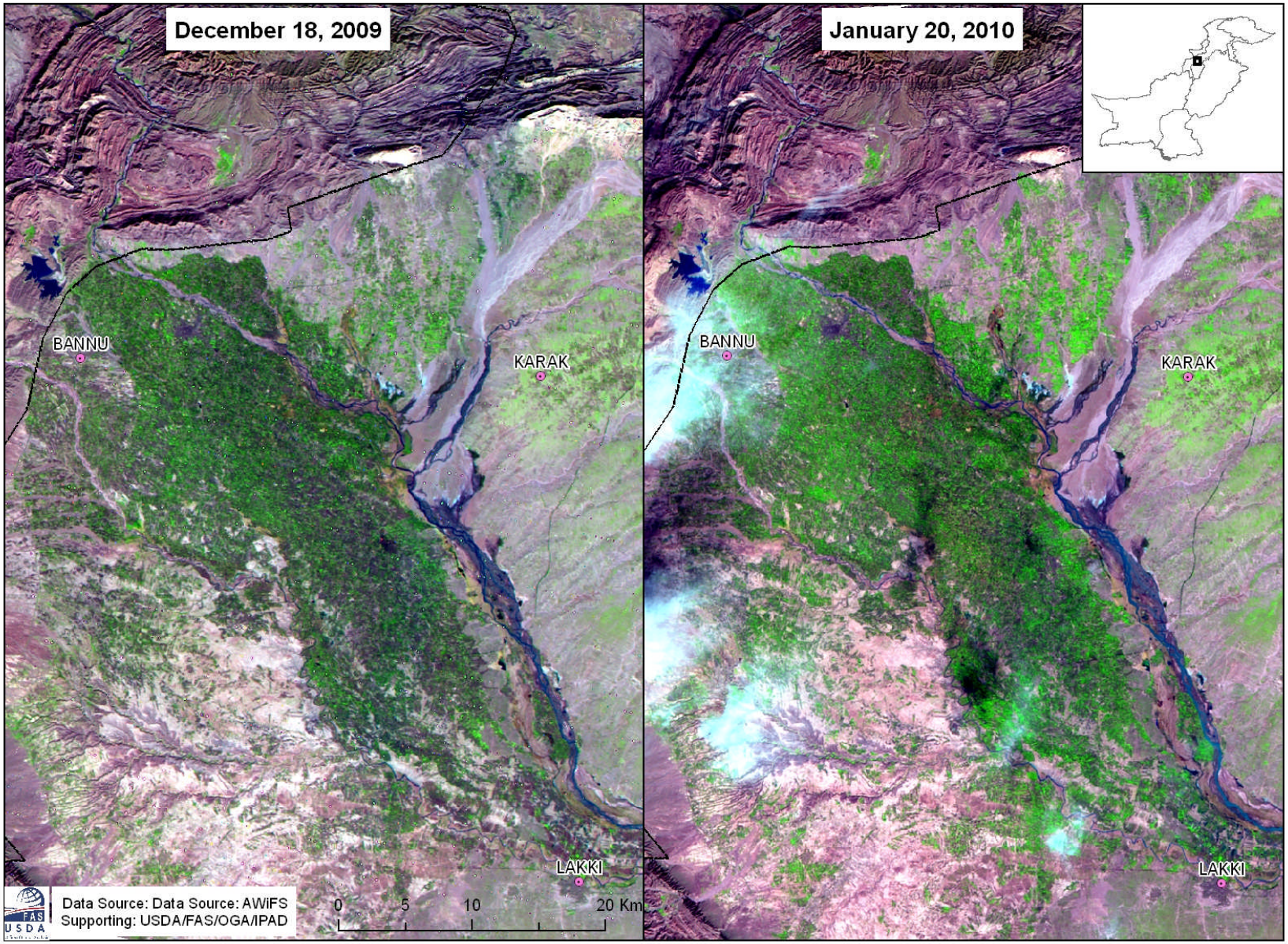

Figure A3. Crop progress in Kurram River Valley, December 18, 2009 – January, 20, 2010. *Data Source: AWiFS*

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NDVI dynamics in Kurram River valley, N.W.F.P., December, 2009 - January, 2010

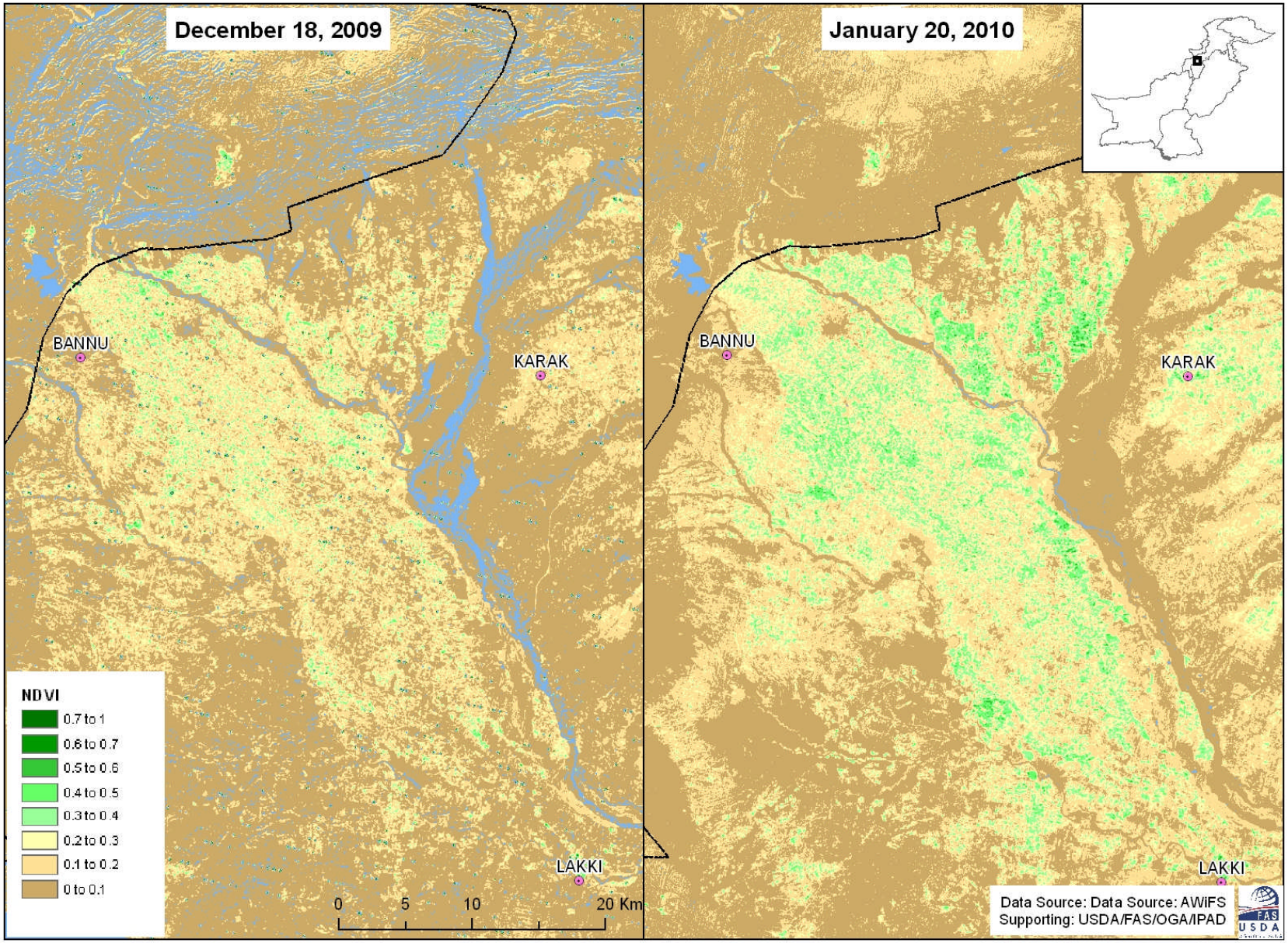

Figure A4. NDVI dynamics in Kurram River Valley, December 18, 2009 – January, 20, 2010. *Data Source: AWiFS*

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Irrigated crop status, Indus River valley, Punjab / N.W.F.P., January 20, 2010

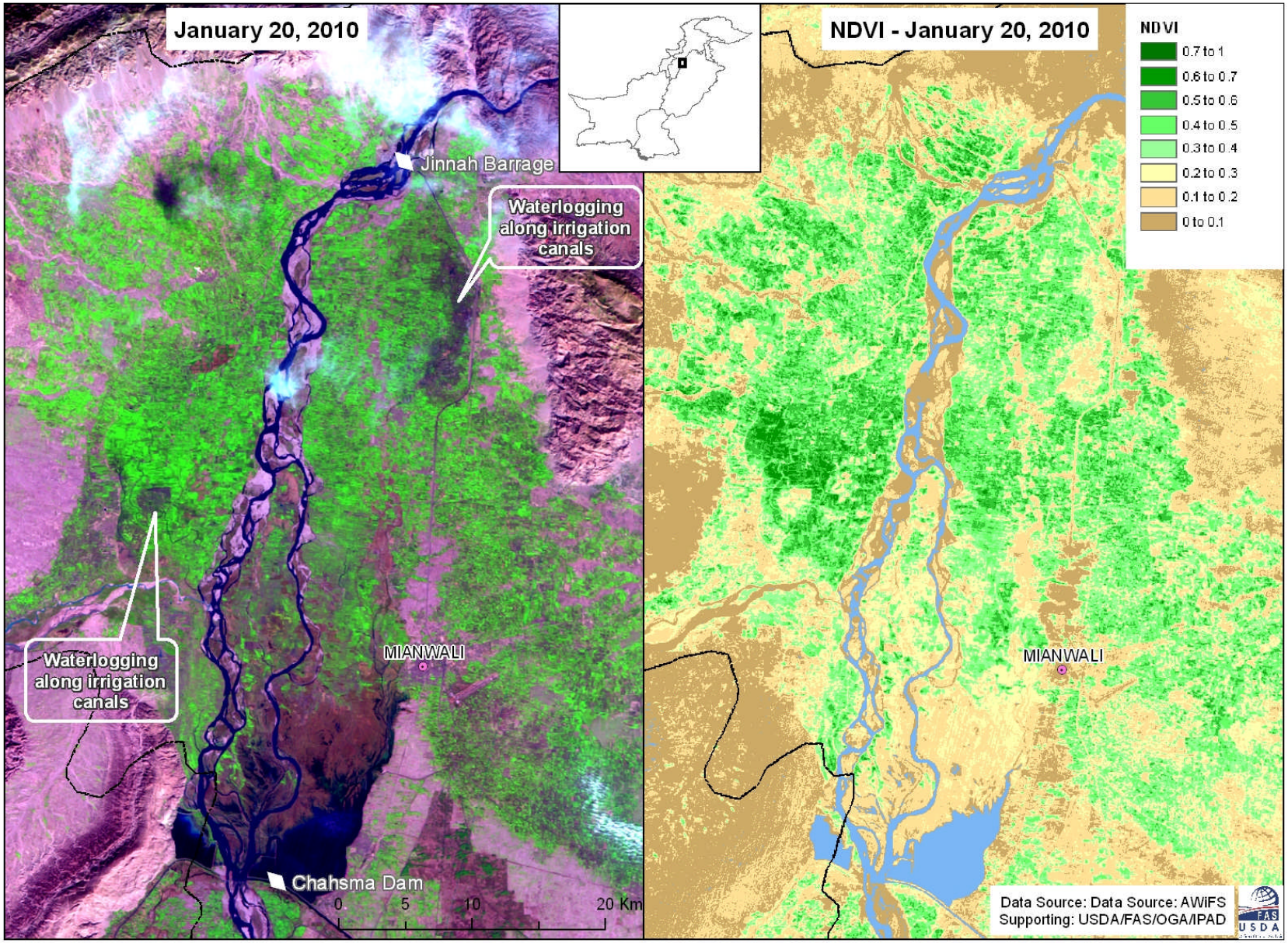

Figure A5. Irrigated crop status, Indus River valley, Punjub / N.W.F.P., January 20, 2010. *Data Source: AWiFS.*

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